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On the Geographical Relations of the Chief Coleopterous Faunæ.

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[Read December 17, 1868.] *

JUDGING simply from their structure, habits, and economy, there are reasons why Beetles ought to excel every other class of organized beings as exponents of the past geography of the globe. I say so after having turned over in my mind and contrasted every class of animals and plants with each other with the view of determining for myself which would be most likely, through the study of its geographical distribution, to throw light upon the past history of the earth. I can think of none so likely to do so as insects, and of insects as Beetles.

Over all marine animals they have the insuperable advantage of inhabiting the enclosed instead of the enclosing spaces, of living on dry land and not being able to go beyond it. Over plants, with which their distribution in many respects accords, they have the advantage of being more difficult of dissemination, for neither their eggs nor themselves are endowed with the dormant vitality of seeds, nor with that endurance of exposure to different condi-

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* This paper was read on December 17, 1868, but by permission of the Council I have brought it down to the state of our knowledge at the date of publication. —A. M.

tions which may, and occasionally does, enable seeds to be carried in the stomachs of birds or floated across wide oceans to distant lands *. They have also the advantage over the larger and more highly organized animals in that they can survive and find food where the latter could not. Their food is so various that nothing but a total extinction of all other life could wipe them off from the face of a country—a partial submergence of land for even a short period might destroy every mammal upon it, but so long as a tree-top is above the flood or an uncovered rock remains on which they can take refuge, the life of the Beetle class is safe when the waters abate. A succession of cold seasons in which no plant can bloom might destroy those kinds of animals for which, like the bee, flowers and honey are necessaries of life, some beetles might indeed then go; but there are plenty that feed on leaves or stems to preserve the Beetle type in the frozen land. Their numbers, too, multiply the chances of escape in the case of disaster, and their powers of flight enable them to take advantage of such as occur. Further, the powers of flight, although sufficient for a moderate distance, are not like those of birds, so great as to carry them to new lands at great distances and so to risk the disturbance of faunas which such powers, if possessed by such multitudes, might possibly produce. In many respects, too, they are as much *adstricti glebæ* as plants themselves, for a vast host are limited each to one particular plant for food. As in plants, indeed, there are some kinds of Beetles more open than others to the suspicion of having been introduced from one isolated land to another, as, for example, the timber-borers or Longicorns. But there are others, as the hunting or carnivorous species, the apterous species, the blind insects, and others of less specialized structure, whose presence in discontiguous countries seems to bid defiance to any explanation other than that of former continuity of soil. In Madeira, for instance, where the number of admittedly introduced species is very great, there is not one introduction belonging to the hunting families; and if this is the case there, notwithstanding the accessibility of Madeira to the introducing agencies of man (to which most of the other introductions are referable), it becomes still more difficult to conceive of the dissemination of that kind of beetles by agencies independent of man.

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* It is a digression, but it is worth making one, to point out that if plants *can* be disseminated in the way supposed, and Beetles, or certain families of Beetles, *can not*, the attempt to explain the distribution of the former as due either solely or mainly to these means must be abandoned in every case where their distribution corresponds with that of the latter. The common effect must have been produced by a common cause. And it so happens that this correspondence exists in all the more important and puzzling facts of distribution.

But besides the advantages which the structure, habits, and economy of beetles give for the interpretation of their geographical distribution, there is another important speciality inherent in them which I shall amply illustrate in the course of this paper, and which renders them peculiarly available for the study of its problems, viz. a long-enduring persistency of form by which the same type has been preserved through diverse modifications during many geological epochs. This peculiarity is shared by all other insects, as well as in different degrees by all beings of inferior organization; and the consequence is that in trying to make out the past history of a country through its fauna and flora, we must take each class of beings by itself and study its relations separately, or we shall run the risk of confounding events belonging to different dates. To do otherwise would be like attempting to compile a history of England by combining the political history of one age with the ecclesiastical of another and the scientific of a third. The mammalian fauna took its present form long after the insects had received theirs, and these earlier-dated forms should therefore be able to tell of events long antecedent to what the mammals could speak of. The relations of each must therefore be studied independently, and it is only after all shall have been separately deciphered that the conclusions respectively drawn from each can be brought together and some common general result arrived at. In the mean time, by endeavouring to ascertain the relative date of appearance of insects of various types in different countries, we may be able to assign the order of precedence of a succession of events whose occurrence we can scarcely doubt, but whose order of date we could not otherwise guess at.

My purpose in the present paper is to submit some inferences of this nature from a general view of the geographical distribution of the Coleoptera, indicating a somewhat different arrangement of land and water in ancient times from that which is usually supposed, and to strengthen these inferences by references to what seem to me corresponding facts in other branches of natural history.

The first point to which I shall direct attention is the very interesting problem of the occurrence of similar forms in the temperate and cold regions of both hemispheres. Hitherto the hypotheses by which this has been attempted to be explained have, I believe, either been: 1st, by accidental introduction; 2nd, by the supposition that the glacial epoch had so modified the climate of the globe as to allow an extension or interchange of faunas lying on different sides of the equator; 3rd, by the supposition that one general fauna had formerly extended over the whole world, and that the similarities which we find in antipodal countries are relics of this general fauna; and 4th, that a former geographical connexion with identity of fauna and flora must have subsisted between the two regions. There is another hypothesis to the effect that the similar species are *representative* species, meaning by representative something different from derivative and independent of affinity. This latter proposition, I frankly confess, is beyond my conception. I cannot conceive of any other kind of representation in species than that arising from derivation. The other hypotheses are entitled to more consideration, and I shall briefly state my opinion upon each.

As to similarity being due to the introduction of species by accidental dispersal, it is to be noted that this cause must always be in its very nature exceptional and isolated, and cannot be expected to make its impress on a whole fauna.

The Atlantic islands, for example, which were, and perhaps still are, very generally cited as an instance of colonization by accidental introduction, have been shown by Mr. Wollaston to have all one coleopterous subfauna, and that one peculiar to themselves. The general basis is European, but overlying that is something else, a number of species of special type found in all and found nowhere else. Now if these islands, as is maintained by some, have been peopled by chance visitors from Europe, how have they all got in addition this special type? and why should there be, as in Trophonius Cave, " vestigia nulla retrorsum "? Why have none of these special forms ever wandered to Europe? Why should things only come from Europe and nothing ever go back in return? There is no law against reciprocity here, and yet it is rigorously excluded. Moreover the explanation, if true, should apply to every part of the globe, and illustrations of its existence should be in greatest force in the lands which are nearest to each other and which have most intercourse with each other. And this is notoriously not the case. Australia, although so much nearer India than Chili, has more affinity with the latter than the former. The Cape-Verde Islands, although so near Cape Verde, have their affinity not with Africa, but with Europe and the other Atlantic Islands. Even in the introductions by man it does not apply. Hear what DeCandolle says of plants. "I am surprised that the commerce of the United States, with Brazil, Chili, New Zealand, the Sandwich Islands, and China, a commerce which has been carried on with great activity for upwards of thirty years, has not yet brought about the naturalization of species from these regions. Up to the present time there is no appearance of it. The *Rubieva multifida*, which has begun to appear at New York, and of which the naturalization is not yet consolidated by the proof of time, is the only plant perhaps which has come in this manner. In future some will arrive, without doubt." [Why so? Surely not from what has happened in the past?] "They may compensate to some extent perhaps the probable diminution of those which will come from Europe"*.

Facts are accumulating upon us to show that diffusion of plants and animals by accidental circumstances beyond physical barriers, such as seas or impassable mountains or deserts, bears no important part in the establishment of any definite fauna or flora. They bear a part, although a small one, in the introduction of occasional new elements into a fauna or flora; but these remain like lumps of stone lying on a soil with which they can neither become incorporated nor harmonize, usually readily distinguishable and referable to the mountains or strata more or less distant from which they have come. Actual continuity of soil and non-interruption by barriers is, I believe, the only cause by which any fauna with a definite character (and no true fauna is without one) has been produced, and subsequent isolation, at least so far as regards physical conditions, that by which it has been preserved. The coral islands of the Pacific are a case in point. They have been supplied both with a fauna and flora entirely from without and by chance dispersal; and they furnish an admirable example of the kind and amount of inhabitants that is to be got by such introductions, even under the most favourable circumstances of tranquil seas, warm climate, and favouring currents; and allowance to such an extent I am always ready to make in examining the elements of any fauna or flora. The details of such a fauna and flora will be given further on when I come to discuss the fauna of the Pacific islands; in the meantime I may briefly characterize it as meagre to the last degree, most unequal in its proportions, and all traceable to the shores of the nearest lands from which the currents set.

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* DeCandolle, Géogr. Botanique raisonnée, p. 755 (1855).

The supposition that the existence of the similarity in question is due to the facilities for migration to or from the northern or southern hemispheres afforded by the low temperature of the glacial epoch is open to various answers. But it is unnecessary to discuss them at all; for I shall presently show that the resemblances to which I have to refer were already in existence before the glacial epoch commenced, consequently could not have been caused by it.

The hypothesis that similar forms occurring at distant places are the remains of a general fauna (or, at least, of a *more* general fauna than now exists), which had in former times extended over the whole or the greater part of the world, is more attractive or more formidable.

I used to think that in that hypothesis I had a satisfactory explanation of all such anomalies as I speak of. Like Shakspeare's barber's chair, it fitted all comers. If the similarity was widely spread, it was due to universal prevalence in former times. If found only in one or two isolated spots, then there were solitary relics of a once universally distributed type! But I confess that my faith in my specific has latterly been a good deal shaken. It costs me nothing to say so, for consistency is a vice to which I have never been addicted. I believe it still to be probably the true explanation of those cases (as in Ferns, for example) where the same type is very widely and generally distributed; but I have abandoned it for most isolated instances, and for all specially localized faunas. In the first place, although I do not dispute that in the earlier stages of the history of our planet there was a greater homogeneity of type than there is at present, it seems pretty well established now, that there have been geographical regions with faunas and floras differing from each other, not indeed to the same degree as now, but to some extent, from the very earliest times of which we have any fossil record; and in the next place, although it is not impossible that a universally distributed form may have died out everywhere but in one or more specified spot or spots, the doctrine of chances prevents us accepting the hypothesis whenever such relics cease to be solitary. Species No. 1 may be a relic left at spots A and B, and nowhere else; but the moment we find another supposed relic, species No. 2, also left in A and B, and nowhere else, doubt assails us, and increases in an inverse ratio with the occurrence of every additional relic.

The fourth supposition is, I think, the true one, namely, continuity of soil at some former period; and upon that as a basis I rest the propositions I am about to submit. Upon it, I think, I can explain satisfactorily many of the remarkable instances of peculiar geographical distribution which have hitherto defied the ingenuity of naturalists to solve, and notably that which I have first set before me, viz. the resemblance which species from the temperate regions of the northern hemisphere bear to those from similar latitudes in the southern hemisphere. With the help of the above postulate I can trace the links all the way from the one to the other plainly in insects, plants, and land-shells, and more imperfectly in the higher animals; but also in them, if allowance be made for the greater variability in form in the higher animals under change of condition of life, and their distribution be examined in relation to the geographical epochs in which the different forms respectively came into being and most prevailed. The absence of particular mammals in a particular land cannot vitiate my theory, if the distribution of animals in it had been completed before the mammals appeared.

For the better understanding of my argument I shall first state the results at which I have arrived.

The position I am about to maintain then is, that, subject to modifications to be afterwards mentioned, all the Coleoptera in the world are referable to one or other of three great stirpes. These three no doubt originally sprung from one stirps, and acquired their distinguishing features by long-continued isolation from each other, combined with changes in their conditions of life. But now we have three, and only three, great strains, sometimes intermingling with each other, sometimes underlying or overlying each other, and sometimes developed into new forms, but always distinguishable and traceable to one or other of the three sources.

These are—1, the Indo-African stirps; 2, the Brazilian stirps; and 3, what, for want of a better name, I shall call the microtypal stirps, in allusion to the general run of the species composing it being of a smaller size, or, more strictly speaking, not containing such large or conspicuous insects as the others. It is not altogether a satisfactory name, because the stirps does contain some large species, and it is not peculiar to it to abound in small ones. But, taken as a whole, its ingredients are smaller and more modest in appearance than those of the others. The fauna and flora of our own land may be taken as its type and standard.

A like tripartite basis may be traced in every class of beings. It may happen, indeed, that one or other of them, as the Brazilian stirps in mammals (Edentata &c., for example), may have almost died out; in others some former stirps, extinct in all the rest, may have survived in some isolated part of the world (as plants in Australia); but, subject to such exceptional modifications, the leading features of my proposition will be found generally applicable to all. It does not come within the scope of my present paper to show more than its application to Coleoptera; but I do not mean to deprive myself of the aid to be derived from the occurrence of a similar arrangement in other classes of organized beings, whenever I find that my position needs strengthening. In many points our materials for working out the subject are so meagre that they require every collateral aid, and it is obvious that the more widely I can show the arrangement to apply, the more will my conclusions, as to their occurrence in the Coleoptera, be strengthened.

The Indo-African stirps, as its name implies, inhabits Africa south of the Sahara, and India and China south of the Himalayas, also the Malayan district, the Indian archipelago, and the New Guinea group. This range is less modified by the general introduction of foreign elements than that of the next stirps.

The Brazilian stirps inhabits South and Central America east of the Andes, and north of the River Plate, and furnishes, moreover, a large share in the constitution of North America, but has also received in return a very perceptible tinge from the microtypal stirps.

In the microtypal stirps I include the fauna of Europe, Asia north of the Himalayas, Eastern North America, so far as not modified by the Brazilian element; and, what has less of this strain, the whole of North-west America, California, part of the Mexican fauna, Peru, Chili, the Argentine Republic south of Tucuman, Patagonia, Tierra del Fuego, Polynesia, New Zealand, and Australia.

When I first broached this view to one of my friends, I was met by the exclamation, "What! Australia and Europe the same! Nonsense: Australia, of all places, is the least like Europe; when you go there you pass into a wholly new country: everything is reversed there; the very leaves grow upside down; it is like visiting some great city of the dead!"

I grant it in some things, but not in all. Before I have done, I trust to prove that, in conformity with the principle I started with (that we must not judge of the fauna of one class by the fauna of another), it is not so in Beetles. It must be remembered that the present flora of Australia once flourished in Europe. Professor Unger may have occasionally allowed his imagination too free a rein, and the determinations of many of the fossil species by him and Professor Heer on which he based his conclusions in his 'New Holland in Europe' may be insufficient or erroneous, but the fact will not be disputed that the Eocene Flora of Europe has many points of correlation with the present flora of Australia. The resemblance no longer exists in the living floras of the two countries; in Australia alone has the old flora survived.

As regards insects, on the other hand, we know, from the researches of Heer and other naturalists, that the Beetle-fauna of Europe in the Miocene time was of the same type as the present Beetle-fauna of Europe and Asia. There are, unfortunately, no similar materials applicable to the Eocene epoch, nor has any one utilized the lesser materials that exist as Heer has done for the Miocene epoch; but from the fact that the insects derived from the still older beds of the Stonefield slate belong to the same stirps (I say so on my own authority and from personal examination), and that the whole of the Miocene materials yet made public, although drawn from several places and beds of different age, all belong to one fauna, it seems probable that the Entomological Fauna of Europe in the Eocene age was the same as in the Miocene. It is an assumption, but not wholly without warrant; and starting from it, my hypotheses is that, like the Eocene Flora in Australia, it has survived in its Eocene form down to the present day; only it has done so more perfectly in England than Australia, while the flora has only done so at all in the latter. In short, I should hold that if the researches of Sir Charles Lyell should end in carrying back the antiquity of man to the Eocene time, and if the ghost of an Eocene naturalist were to be allowed to revisit the glimpses of the moon, he would find in Australia the type of both the plants and beetles very much as he left them. In Europe he would find only the beetles. Indeed I am strongly disposed to claim even a greater antiquity for our present Coleopterous fauna. Some may remember that when insect remains were first found in the coal-formations, the surprise was general among naturalists at finding them so small in size and so little different from those of the present day. They expected that they should have been as much beyond the existing type in size and splendour as the Megalicthys exceeds a Herring. Nature, according to the notions of those days, was in her youth in the Carboniferous epoch, and they expected something of the extravagance of youth in her proceedings. It now seems more probable that the Coleopterous fauna there was the same *in type* then as now, and that it has continued so in the region I speak of for all the intervening period, in accordance with the rule already referred to, that the lower we descend in the scale of organization, the more persistent is the general character of the forms of which life is composed.

It is not a reply to say that the Eocene flora, which has changed in Europe, being lower in the scale of life than the fauna, should have been equally persistent. It is not lower in the scale of life than insects. They are not in the same scale at all. They are on two distinct and separate ladders; and the Eocene plants, which have changed, were high up on their ladder (the very mammals of vegetable life), while the Eocene Coleopterous fauna was low down on its. It is to be borne in mind, too, that we have every reason to believe that the changes in condition of life since the Eocene epoch have been much greater and more frequent in Europe than in Australia; and if the plants are accepted as being more likely to change than the insects under altered conditions in life, it is in Europe rather than in Australia that a change in them was to be expected.

Of course, in what I have been saying, and shall further say on this subject, I speak of the Coleopterous fauna of Australia as a whole. In one sense it cannot be disputed that it is different from that of Europe. The species are not the same, and there are a multitude of peculiar forms; but the type, especially of what I regard as the more important test-groups, such as the hunting unintroduceable species, is the same. The peculiar forms can almost always be traced back to enlargement or development of some microtypal form. Putting aside such exceptions, the general facies is the same, and a large proportion of the genera are the same, and it will be still greater when we get rid of the feeling that the genera must necessarily be different, because they come from such a distant country. Some of the species are scarcely distinguishable from our own, and even the relative proportions of numbers of species and genera in different groups are the same.

My conviction is, that there has been certainly one, possibly two, great continental routes of communication between the northern and southern hemispheres, both now lying buried in the ocean,—the one at the bottom of the Atlantic, the other in the depths of the Pacific; and I hope, from an examination of the traces left on the ruined piers which mark the course of these ancient viaducts, to show the course that they took and the inhabitants that used them.

If any one, following in the steps of Sir Charles Lyell, objects to such a wholesale erection of continents on the ground of their magnitude, I have only to remind them of the vast extent of land which has appeared above water since the Tertiary epoch. Some drying up of the ocean during that period no doubt has taken place, but nothing sufficient to account for the immense tracts of country which have become dry land; and it is not a matter open to argument or discussion, but a mathematical necessity, that if land, previously below the water, comes above it, a corresponding quantity of land which was previously above it must then go below it.

Let us now turn to the three great stirpes, and pass each of them in review, trace their course, and determine their limits. I shall begin with the microtypal stirps (with which we are most familiar). It is the most extensive of the whole, being distributed over the whole world, with the exception of the Indian, African, and Brazilian regions; and even they, from various exceptional causes, have a greater or less tinge of it in their faunas. It contains some minor faunas, and these, again, a number of subfaunas. The Europeo-Asiatic region is one of these minor faunas, and of it the Atlantic islands, the Mediterranean, and the Mongolian are subfaunas. Taken as one fauna, the Europeo-Asiatic extends from the Azores east to Japan, the whole of that vast space being inhabited entirely by the same type and, for the most part, by the same species, a few only dropping off here and there, and being replaced by others of the same general character. As to the Atlantic islands, the task is easy to decipher their relations; Mr. Wollaston has done it ready to my hand in his various admirable researches on their Coleoptera. It would be idle to vaunt the merits of his works to Fellows of the Linnean Society. Mr. Wollaston is one of our number, and we are entitled to regard his honours as gems in our own chaplet, if not laurels of our own growth. In interpreting the faunas of these islands, I have only to recapitulate the results of his researches; on almost every point I arrive at the same conclusions that he has done. He has removed all possibility of doubt as to the general identity of the faunas of the northern groups with that of Europe, and notably with the Mediterranean section of that fauna, or as to their individual identity with each other as members of one and the same subfauna. In the Madeiran group (see 'Insecta Maderensia' and 'Catalogue of Madeiran Coleoptera') he showed that out of 580 species, 314 are species already known on the Continent of Europe; true, he considers (in which he goes further than I would) that so many as 120 of these had been imported by man, or otherwise found their way to the islands; but, even after deducting these, he leaves 194 known European species aboriginally present, as against 266 endemic species. These endemic species, again, are all akin to the European forms, fit easily into their places among them, and all possess the facies of that fauna. I have already alluded to the want of reciprocity between Madeira and Europe in regard to any specialities they possess, and shall merely illustrate that remark by noting the fact that, although Mr. Wollaston credits Europe with a recent remittance of nearly the half of the European species, he acknowledges that no repayment in kind has ever been made by Madeira, not a single example of any of its peculiar species having ever found its way to Europe, except in an entomologist's box; and this, be it remembered, although the means of introduction have been at least as open on the return as on the outward voyage *.

In the Canary Islands (see 'Catalogue of Canarian Coleoptera')

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* I know it may be replied to this that an unusual proportion of the Madeiran endemic species are apterous; but this, even although it were a good answer, would only account for the deficiency of a proportion equivalent to the relative number of apterous, as against winged species; but it is not a good answer even as regards them; for no one supposes that the introduction of species from the continent to Madeira has been by actual flight. It is floating wood and birds that are usually referred to as the vehicle or mode of transmission.

Mr. Wollaston next found that out of a total of 930 species, 224 are identical with Madeiran species, and, notably, that the same peculiar types which gave to Madeira the character of a subfauna, are also present there in force. The Cape-Verde Islands tell the same tale. Previous to the appearance of Mr. Wollaston's 'Coleoptera Hesperidum,' the usual belief among entomologists was, that the fauna of the Cape-Verde Islands partook more of that of the coast of Africa, nearest which they lie, than that of any other country. Mr. Wollaston has shown that this is a mistake. In his introductory remarks he says, "Our recent explorations in the Cape Verdes have shown their Coleopterous population to be so far more than I had anticipated on the Canarian and Madeiran type, that I am anything but certain that it would not be more natural to regard the *whole* of these Atlantic islands as characterized by a *single* fauna—unmistakably the same, even whilst necessarily differing as to many of its exact details (and through the fact of mere *distance*) in the more widely separated groups." From my own materials I rather inclined to the more general notion, and I therefore carefully tested Mr. Wollaston's conclusions by his data, and the result fully corroborated his view. Out of 275 Cape-Verde species, 91 were common to the Canaries, and 81 to the Madeiran group. The African element proved slight, as Wollaston said, and such as might fairly enough be referred to chance introductions from the opposite coast of Africa. The European element continues, as before, the staple, and a new phase of the peculiar endemic subfauna of Madeira is also a characteristic element of its fauna.

In support of the above statements, I shall merely specify one or two of the most striking of the types which are present in all the Atlantic-island groups under the same or similar forms. In Madeira the Heteromera are characterized by the presence of the endemic genera *Hadrus* and *Hegeter*, *Hadrus* having three species, *Hegeter* only one. In the Canaries, *Hadrus* has disappeared, but *Hegeter* has nineteen species, and in the Cape Verdes *Hegeter* is reduced to one, but a new form, *Oxycara*, has taken its place with ten species. In Madeira, the Curculionidæ are distinguished by a profusion of Cossonidæ containing new genera and new species in a marked degree. The same prevails in all the islands; so with *Acalles*, a small genus with few species in Europe, but with an especial redundancy in all the islands. *Atlantus* or

Laparocerus is another special new development confined to them, but present in most of them in greater or lesser numbers; thus in Madeira there are thirteen species, in the Canaries thirty-five species, none in the Cape Verdes, where, however, *Dinas*, a new Brachyderidous insect, similar to it in appearance, comes either to take its place or that of *Brachyderes*, which is also found in some of the Atlantic groups. In the Clavicorns, the remarkable genus *Tarphius*, a consideration of whose relations would require space which cannot be given here, characterizes the Canaries and Madeira, as *Attalus* does in the Malacodermata.

As to the Azores, Mr. Crotch has completed Wollaston's work for him there. As a matter of sentiment, one would have liked to have seen the whole finished by Mr. Wollaston himself, as he had done so much and so well; but the naturalist is rather ungrateful in this respect, and cares little how he gets his knowledge, provided he does get it. Mr. Crotch's contribution therefore (Proc. Zool. Soc. 1867) is a welcome, as it is a trustworthy and careful, record of the Coleoptera of the Azores. His materials are, indeed, far less complete than Wollaston's in the other islands; but although imperfect as regards proportions, they sufficiently reveal the character of the fauna. Mr. Crotch records 213 species, of which 160 are European; and among those not European, he describes a *Tarphius*, a *Laparocerus*, an *Attalus*, an *Acalles*, and a new member of the Cossonidæ—all sufficient indications of the Azores being a member of the same system as the other Atlantic islands. How the European character of this general fauna is to be accounted for, except on the supposition of a former connexion of them all with Europe, and how the presence of these special forms of the same subfauna in all the islands, and nowhere else, is to be accounted for except on the supposition that, after they were disunited from Europe, they were still united among themselves, it is for those who advocate the theory of dispersal by chance introductions to say.

The Azores seem to occupy nearly the western extremity of this ancient land; not far beyond them a deep valley, the deepest part of the Atlantic, intervenes between them and the coast of America. Up this the Gulf-stream scours, as it probably has done from early days far back in geological time; and if there is any place in the world to which we might reasonably expect a few waifs and strays to be brought by currents, it would be the Azores; and yet there are only three in this position, all Brazilian and all insects which probably pass their larval state in timber; they are an Elaterid (a species of *Æolus*, *Æ. melliculus*), which is found all along the coast of South America from Rio to Demerara, *Monocrepidius posticus,* another Elater which is otherwise confined to the La-Plata district in South America, and *Tæniotes scalaris*, a Longicorn. In the other Atlantic islands there is only one such introduction, a North-American Longicorn (*Clytus erythrocephalus*), which has been found on the Salvages. The supposed introductions to the Azores from the European side of the Atlantic are, according to Mr. Crotch, much more numerous. He divides the 170 European species of the Azores into "two groups (70 possibly indigenous and 101 almost certainly introduced by colonists);" and the mode of introduction assigned by him is (I know not on what grounds or with what *primâ facie* probability) their importation in earth at the roots of garden-plants. Certainly in this case the operations of the chance-introduction theory (three species coming with the current against 101 against it) would seem to call for some apology or explanation; but those who, like myself, reject that theory as capable of doing any thing more than furnishing accidental exceptions, will only see in the 101 supposed introductions (probably, but not necessarily, under deduction of a few cosmopolitan species) 101 natural denizens belonging to the microtypal stirps, and present in their natural capacity of legitimate descendants of the aboriginal heirs of the soil.

The only remaining vestiges which may be supposed to have formed part of this ancient Atlantis are Ascension Island, St. Paul's, St. Helena, and Tristan d'Acunha.

Of these, St. Paul's is, I believe, beyond its limits, and belongs to another fauna and another stirps, its fauna, so far as I know, being Brazilian; but more information is still wanted regarding it.

Ascension Island is a barren rock of recent formation, said to be almost without any fauna but what has been introduced by man within a hundred years or so; but it has never been thoroughly examined by any competent naturalist. What we do know of it has been picked up during brief flying visits by naturalists who, like Mr. Darwin, touched at its port, and did what they could in a limited time. The only animals recorded, so far as I know, are one Slug (*Limax ascensionis*), and, if we go by that, we must put it down as microtypal, and two Sea-shells (*Litorina milaris* and *Nerita ascensionis*), found by Mr. Cumming on its shores.

St. Helena, that great puzzle of naturalists, is a crucial test to my hypothesis of a communication between the northern and southern hemispheres by an Atlantic continent; if that link snaps, the whole chain will fall to the ground. It will, of course, not touch the evidence for a communication between the northern and southern hemispheres by the Pacific; but a microtypal St.-Helena fauna is vital to an Atlantic communication. I say that its fauna is certainly microtypal, and if so, almost necessarily a branch of the Atlantic type of that stirps; there is nothing else microtypal within reach for it to be attached to. Some three years ago Dr. Hooker gave an admirable lecture on oceanic islands *, in which he discussed the origin of the flora of St. Helena, and on the whole seemed inclined to refer it to Africa. More in the spirit of "audi alteram partem" than from any settled conviction of my own, I wrote a reply †, in which I gave some reasons for thinking that it might more probably have been originally connected with and peopled from Europe, although also possibly connected at some period with Africa. More mature consideration and subsequent researches have confirmed my opinion; and the following examination of the character of its plants and animals will show the grounds on which I rest it.

In mammals, of course, nothing is to be expected. The only allusions to them that I can find is the statement ‡ that in cutting away the lava at Ladder Hill, many feet below the surface, small bones have been found, apparently about the size of those of a rat, and more particularly a small rib-bone entirely covered with an incrustation of stalactite. In what manner these have originally come there must ever remain a mystery: there is but one probable mode of accounting for it, on the supposition that the animal might have crept into a crevice of the rock and there died; for if a bed of lava in its liquid state had flowed over them, they would probably have been consumed, and would not have been found incrusted by stalactite. I find it also recorded in 'Baynes's Tour through St. Helena,' p. 119 (1817), that at the beginning of this century the "Manati or Manatee, Sea-cow or Sea-lion" existed in such numbers as to furnish employment for a fishery on it; and of course if the Manatee did exist there, it

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* Published in 'Gardeners' Chronicle,' January 1867.

† Published in 'Gardeners' Chronicle,' February 1867.

‡ See 'Proceed. Agri. and Hort. Soc. of St. Helena,' 1826, p. 30.

would be almost proof positive of former continuity of land with some country where the Manatee lived; for it is a herbivorous animal, and could neither have crossed from South America or Africa (where different species of Manatee still live) to St. Helena as it now stands. But it is not a Manatee; the observer from whom Baynes quotes says it is undoubtedly the Sea-lion of Anson, and gives a description of it, which shows that it must have been a species of Seal, doubtless that which he supposes (the Sea-lion, or *Phoca leonina*), which also occurs at Tristan d'Acunha, and yields plenty of oil, Carmichael mentioning that one animal there will give 70 gallons.

In ornithology there is, I believe, only one undoubted aboriginal land-bird, the *Charadrius pecuarius* of Temminck, a small Plover, named the Wire-bird (probably so called from its wire-like legs). It is so exceedingly close to the Cape *C. Kittlitzii*, that it has been confounded with it by ornithologists; until lately it was shown by Mr. Layard to be distinct. The Plover (and like the others this Cape species) is a migratory bird, consequently it is not difficult to suppose that it might, in the course of its migrations, have been blown off from the coast of Africa to St. Helena. But after arriving there it must have become modified by the altered conditions of life into the *C. pecuarius*, and, among other modifications, ceased to be migratory, for that bird is a constant resident in St. Helena all the year round.

Baynes, in his 'St. Helena,' speaks of the Grenadier Grossbeak (*Loxia orix*) as an inhabitant, and says it is locally called the Wire-bird. That it is so called is certainly a mistake; but if really an inhabitant of St. Helena, it does not seem a likely one to have been introduced; and if not introduced, then it certainly is microtypal, all the species of the genus being confined to the northern hemisphere. If the Canary has not been introduced, it would be another microtypal species, and more than that, a species belonging to the Atlantic subfauna. It is, however, said to have been introduced either intentionally or involuntarily by man. It is suited to the climate, and being a universal favourite of man, nothing seems more likely than that it should have been introduced by the escape of cage-birds; but I cannot learn that the belief rests on anything more than presumption and probability; and it may be said, on the other side, that if St. Helena was once a member of the Atlantic fauna, it is natural that it should occur there, and that, although so great a favourite and universal a companion of man, it is not found naturalized in any other islands, notwithstanding that hundreds exist equally well adapted to it and equally inhabited by canary-loving settlers ; a sufficient reply to which may be that there is no island exactly similarly situated in regard to man's arrangements, and that other birds of a similar nature have actually been naturalized there, the Java Sparrow and Indian Haverdavats being known to have been introduced, and the fact and date of their introduction being on record. They have thriven as well as the Canary, all three being as common as Sparrows. All, however, that I wish to do is to enter a caveat against taking the introduction of every microtypal species for granted. My own belief is that there are no aboriginal birds in St. Helena : perhaps its isolation was perfected before birds appeared in the lands with which it had previously been connected. Besides the above, the Common Fowl, the Guinea-fowl, the Pheasant, the Red-legged Partridge, the Peacock, and the Pigeon have all been intentionally introduced by man.

Governor Beatson gives the names of a very few of the seabirds found on or about the island; but their range is so wide that they can scarcely be cited as bearing on this inquiry.

The Turtle is the only reptile mentioned as found at St. Helena, but no freshwater reptiles or fishes are known; at the same time it must not be assumed that none can exist. Although there are no streams, there is water, and there are terrestrial and marsh-shells (*Succineas*) ; and if the advocates of chance dispersal are correct in their reasoning, small fishes from distant lands might now and then be introduced by sea-birds. It is against their theory that they have not.

Governor Beatson (*loc. cit.*) also gives a list of seventy marine fishes taken at St. Helena ; but as they are all designated by their local names, it is of no scientific value. Passing it, we have a thoroughly scientific and dependable, although smaller, list in two parts by Dr. Günther, in the 'Proc. Zool. Soc.' 1868, p. 225, and 1869, p. 238, made from a collection sent by Mr. J. C. Melliss, a resident in St. Helena, to whom naturalists owe more than to any previous observer for information as to its zoology. It will presently be seen that, besides the fishes, his collection of spiders and beetles supply the most important part of our material in these classes of animals. A copy of Dr. Günther's list will be found in the Appendix. It is not to be expected that the marine fauna can be applied in the same way as the terrestrial fauna to the elucidation of the distribution of animal life, nor does it follow that because we see certain great divisions in terrestrial distribution, the same number and the same local distribution is to be found in them also; greater latitude and extent of range must be allowed to marine animals, and especially to fishes (the birds of the sea), than to land animals. The difference in their conditions of life in the sea is less than on land. Geological changes, such as the opening of the Isthmus of Panama and the Isthmus of Suez, have a more important bearing upon their distribution than upon those of land animals, inasmuch as the opening of a door to admit a new element is more important than shutting it after it has been already admitted. The knowledge that such events have taken place, however, enables us to reconcile the occurrence of marine animals in places otherwise difficult of explanation, as, for example, *Saurus atlanticus*, both at Madeira and Zanzibar. With the help of such aids I by no means despair of being able to show that a similar distribution, in the main, exists in marine animals to that in terrestrial; not exactly placed alike, but proceeding from the same causes, and the deviations traceable to the different treatment, conditions and events to which they have been subjected. Their distribution must be studied (and happily we have the means of doing so) more in connexion with their geological history and the fossil remains of their ancestors. It is not my present business to attempt to do this; and I shall not do more than indicate the line of argument which such considerations, at first sight, seem likely to lead to. Take the Sea-perches, the Percidæ (not merely the genus *Serranus* as now understood, but the group of allied genera of which it may be said to be the type), a group containing the first dozen species in Dr. Günther's list. Beginning in the Chalk with genera which are now all extinct, increasing in the Eocene, so that half of the genera now survive and are established in the Newer Tertiary, so that all the genera now existing were then present in England, that type would appear to be properly microtypal.

The sea-shells being for the most part dependent on the lands on whose shores they live, and therefore bound to them, are safer and more direct indications of the character of these lands than the fishes; and their own stirps generally corresponds with that of the terrestrial inhabitants, although, from the causes already alluded to, they are sometimes exposed to diverging influences from which the latter are free. We have as yet, so far as I know, no list of the marine mollusca of St. Helena. Mr. Woodward in his manual mentions that Mr. Cuming collected sixteen species of sea-shells, of which seven are new. I cannot find that he has published these; probably Mr. Lovell Reeve may have done so in his 'Conchologia Iconica,' but I have not found them. Mr. Cuming's collection, however, is now in the British Museum; and besides there are in it a number of other shells collected at St. Helena, amounting in all, with his, to about fifty species. I have gone hastily over these under the kind and able guidance of Mr. Baird; and although I should be sorry to attempt anything like the determination of the species on the strength of such a hasty inspection, yet I think I may venture to give a list of the genera to which they belong, especially as I had Mr. Baird at my elbow to advise me when I was making my notes upon them. I accordingly give a copy of my memoranda regarding them in the Appendix. On looking at this, I think conchologists cannot fail to be struck with the correspondence of the distribution of the species found there with the Coleoptera belonging to my microtypal stirps. The range of many of them is put down in our books as world-wide, just in the same way as many of my microtypal genera of Coleoptera stand as cosmopolitan, merely because they are found at distant points of the microtypal range; thus *Lucina* is world-wide because it is found on the coasts of Europe, North America, the West Indies (a debateable frontier in all classes of animals), St. Helena, Tierra del Fuego, New Zealand, and Japan (all microtypal), and its fossil distribution corresponds so far as we know it. So *Mytilus* is world-wide. Mr. Woodward's localities are "world-wide—Ochotsk, Behring Sea, Russian Ice meer, Black Sea, Cape Horn, Cape, New Zealand." Others, such as *Venus*, *Venerupis*, *Corbula*, &c., have the same microtypal habitats, with the addition of the Indian Ocean, which may have been reached through the Red Sea when the ports of the Isthmus of Suez were open. The Patellidæ, the Rissoidæ, *Litorina*, *Cæcum*, *Cerithium*, *Chemnitzia*, *Eulima*, *Nassa*, all occupy microtypal ground. It seems to me, too, that the others, which are more widely distributed, will be found to be of older geological date.

The land mollusks are of course better authorities as to the character of the fauna of the island. We have, however, no list of them, although Mr. Benson has described some of the living and Edward Forbes some of the fossil species, and also made a few remarks on them in the Geological Society's Journal, 1852, p. 197, and elsewhere. I have therefore combined these, and shall venture to add similar notes as to the genera and a few of the species from the British-Museum collection to those which I have given of the marine species. With one exception, they are all European-looking Helices, Bulimi, Pupæ, Succineæ, and similar forms; the exception is a large semifossil *Bulimus* (*B. auris-vulpina*, Reeve) which looks recent, but of which the animal has never been found; the nearest affinities of this species have been thought by some to be with Polynesia. The affinities of the other species have been thought by conchologists, I believe, to lean most to Chili; but this I apprehend to have arisen rather from a reluctance to look for this relationship in our own land. Divested of prejudice, it is difficult to conceive anything more close in appearance to the British species without being actually identical than they are, and any greater resemblance to the Chilian species I believe to be impossible; and if it did exist, it could not go for much, for the land-shells of Chili are microtypal too, many of the Helices and Bulimi being exceeding like those of Europe; and we all know that two things which are each equal to a third are equal to each other. Others have sought to account for this close resemblance to our own species by supposing them to be modifications of species brought in the earth at the roots of plants from Britain. The occurrence, however, of so many other species in other classes like our European species seems fatal to this view.

Of other sea animals, I have to mention two species of an Annelid (*Ditrupa*), also of a northern type.

There are four Crustaceans mentioned by Governor Beatson —Shrimps, Crawfish, Stumps, and Long-legs—which by their names and the character ascribed to them by Governor Beatson, viz. that they resemble our lobsters in taste and colour, suggest our northern species; but in ignorance of what they really are, we must pass them by.

The Rev. O. P. Cambridge has lately reported on a small collection of spiders made by Mr. T. J. Melliss, and described the new species in the Zoological Society's 'Proceedings;' and he says that so far as so small a number of species (only twenty-two), of which nine were new, may justify a general remark upon the character of the Araneidea of St. Helena, it appears to bear a thoroughly European stamp, one alone belonging to any genus not indigenous to Europe. Four, if not five of them have been recorded as indigenous to Great Britain, three to Algeria, and three to Egypt. Among the new species Mr. Cambridge found "but little to denote a locality so near the tropics." (See extract from Mr. Cambridge's paper in the Appendix.)

Mr. Cambridge also records two Scorpions from St. Helena in the same collection, *Lychas maculatus*, Koch, and *L. americanus*, Koch (American but easily introduced).

The butterflies seem as badly represented as the birds; and I would recommend to the consideration of the advocates of introduction by chance dispersal the fact that the two classes of animals best provided with means of dispersal are precisely those which, along with the mammals, are least represented. I can find no published notice of any Lepidoptera in St. Helena. No specimens of any exist in the British Museum; and the solitary species that I can learn by inquiry to have been met with is the *Cynthia Cardui* *. *Cynthia Cardui,* I need scarcely say, is what is usually called a cosmopolitan species; but in very many instances it will now be found that what have been called cosmopolitan forms are only microtypal, that is, found in every part of the world but those parts of India, Africa, and Brazil to which the microtypal stirps had not had access.

Until lately, our knowledge of the Beetles of St. Helena was limited to some twenty species or so. Mr. Wollaston has recently, however, considerably extended it, mainly through the researches of Mr. Melliss and Mr. Bewicke, and has published a catalogue (see 'Annals of Natural History,' 1869 and 1870) in which seventy-five species are enumerated. His observation upon these is as follows. "If we exclude from consideration the twenty-six species (above alluded to) which have *unquestionably* been brought into the island through the medium of commerce, and which enter into the fauna of nearly every civilized country, I need scarcely add that the St.-Helena list, as hitherto made known, possesses nothing whatever in common with those of the three sub-African archipelagos which lie further to the north—though the great development of the Curculionideous subfamily Cossonides is a remarkable fact which is more or less conspicuous throughout the whole of them."

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* Prof. Westwood is my authority for this, and for the sake of preserving the information he gives, I quote what he says: "As to the insects of St. Helena, I am sorry to say that I can give you scarcely any information. In one of Dr. Burchell's cabinets was a drawer filled with insects from that island, but it unfortunately had no door and had been left neglected. After Dr. Burchell's death some wretched moths got into that particular drawer and devoured nearly everything. I kept all the fragments possible, and can determine some fourteen or fifteen species of common forms, *Coccinella, Sepidium, Necrobia, Cynthia Cardui.* It fortunately happened that the type specimen of the curious *Aplothorax Burchelli* remained intact."

In this judgment I cannot concur; the list seems to me bristling with Atlantic affinities and points of correspondence. It is one of the very few instances in which I do not go entirely along with my friend Mr. Wollaston's conclusions; and I believe the difference on this occasion arises chiefly from our looking at the subject from opposite stand-points. I am looking at it as part of a larger stirps, he as an independent object. I am anxious that he and the large number of readers who, relying on his well-known judgment and acumen, will naturally accept his conclusions as their own *in fide parentum*, should see that I have strong grounds for dissenting from him; and I have therefore given in the Appendix a copy of the list of species recorded by him distributed into the stirps and faunas to which I think they belong, with full notes containing my reasons for placing them as I have done whenever any doubt seems likely to exist about the matter. On referring to this, it will be seen that, according to my view, the seventy-six species as yet recorded as inhabiting St. Helena (whether by Mr. Wollaston or others) are to be accounted for as follows. There are:—

1. Of doubtful identity and uncertain locality through the fault of the original describers ...	2
2. New endemic species which I have not seen either in nature or figured, and as to the affinities of which I am thus unable to form an opinion	2
3. Cosmopolitan or introduced, which, with two exceptions, belong to the microtypal stirps ...	13
	17

Deducting these 17 from the total 76, there remain 59 belonging to the different stirps as follows:—

South-American stirps	1
Indo-African stirps	2
Microtypal stirps, European branch....	56
	59

Of 56 members of the European branch of the microtypal stirps, I find 12 which have no greater affinity for one part of the European fauna than another, 3 which are new, but whose general affinity lies with species characteristic of the Mediterranean subfauna, 40 whose affinity is nearest to the fauna of the other Atlantic islands, and 1 (*Pristonychus complanatus*) which is generally distributed in microtypal countries, and which has hence been supposed cosmopolitan, but which in reality has not been found out of the microtypal bounds. Much of the weight to be given to this apportionment of the elements of the isle must depend on the value of my reasons which are given in the notes to the list of species in the Appendix, and to these I must refer the entomological reader. I may only say here that the instances which have had most weight on my own mind, are, 1st, the occurrence of a large *Carabus* (a hunting carnivorous genus limited to microtypal countries, which it would seem impossible to introduce except by continuity of dry land), which, according to the high authority of Prof. Lacordaire, has most affinity with species found in Syria (*i. e.* in the Mediterranean district with which the Atlantic Islands are otherwise most connected); 2nd, but of still more importance, the presence of species of genera which are particularly prominent or abundant in the other islands, as *Calosoma*, *Bembidium*, *Læmophlœlus*, *Anobium*, *Opatrum*, &c.; and 3rd, and of most importance of all, the presence of new forms allied to species already known as characteristic of or confined to the other islands of the Atlantic, as *Microxylobius*, *Nesiotes*, and *Notioxenus*, representing respectively the prevailing element of *Cossonus*, *Acalles*, and *Atlantis* in them. That a particular genus is represented (however critical this genus may be), when the representation is only by a single species, is not nearly so strong evidence of common origin as common exuberance of some particular form in both faunas under comparison; for the occurrence of a single species may be explained away when the presence of many defies dispute. And I rest as much on the occurrence of the typical character of facies as on actual identity of genus or species; for in the development of new forms Nature often refuses to go by our generic characters, and produces something exactly similar in appearance but with some deviation in what the systematist chooses to call important organs, a deviation which to his mind is fatal to generic identity, but to mine insignificant in the face of persistence of facies.

So far as the fauna goes, therefore, I have little doubt that the majority of zoologists will agree with me in referring it to the Atlantic subfauna of the microtypal stirps. But when we come to the flora, we have new light thrown upon the subject. It is said to be rapidly losing its original features; when Burchell visited the island, it was still nearly in its natural condition, and out of 169 plants collected by him, 40 were endemic and very peculiar, and of the remainder, a considerable proportion seem to have been of European type. Dr. Hooker, in his lecture on Oceanic Floras, says of this, "Dr. Burchell's collection includes 169 flowering plants, but most unhappily he has not indicated which are *bonâ fide* natives and which have followed the track of man and animals introduced by him, and which have become quasi-indigenous or naturalized. Some years after Dr. Burchell's visit, however, an eminent Indian botanist, Dr. Roxburgh, visited St. Helena, and drew up a catalogue of the indigenous, naturalized, and cultivated plants then existing, carefully indicating the truly indigenous ones that were then surviving." This flora of Dr. Roxburgh's, however, is imperfect, some of Dr. Burchell's species (now in the Herbarium at Kew) not being included in it, probably having become extinct in the interval between his and Burchell's visit; and a strong desire is felt by those interested in the subject that a fresh flora of St. Helena should be published by some competent botanist. Dr. Hooker's talents, position, and acquaintance with the subject point him out as the most fitting person to do so: and I trust the general wish that he may undertake it will lead to its own fulfilment.

As our knowledge of the flora stands, however, I believe the actual facts which have been ascertained regarding it are that it contains, 1st, a considerable number of plants known to have been introduced from various countries, but chiefly from Europe; 2nd, a considerable number of European species or genera which are not known to have been introduced, but which are taken for granted to have been so on account of their European habitat; 3rd, a small proportion (but still too large a proportion to be accounted for by chance dispersal), the affinities of which are clearly with the Cape flora. Dr. Hooker's conclusion to this effect is thus stated in his lecture above referred to:—"From such fragmentary data it is difficult to form any exact conclusions as to the affinities of this flora; but I think it may be safely regarded as an African one, and characteristic of Southern extra-tropical Africa.

The genera *Phylica*, *Pelargonium*, *Mesembryanthemum*, *Osteospermum*, and *Wahlenbergia* are eminently characteristic of Southern extra-tropical Africa ; and I do not find amongst the others any indication of an American origin, except a plant referred to *Physalis*. The Ferns tell the same tale ; of twenty-six species, ten are absolutely peculiar ; all the rest are African, although some are also Indian and American." On this sentence, while I implicitly accept its conclusions, I shall only remark :—1, that Mr. Baker, in his admirable paper on the geographical distribution of Ferns, seems to me to be a little more favourably disposed to America in his estimate of their relationship ; 2, that some of the African species, as *Banksia* and *Protea*, may have an Australian significance as well as an African—not that I think that either touches Dr. Hooker's conclusion, but in trying to sum up impartially I do not wish to overlook any point ; and 3, that there is besides what may be called an under layer peculiar to the island itself, and found nowhere else on the face of the globe, such as arboreal Compositæ (tree-daisies, as it were). Dr. Hooker regards these as too abnormal to have their affinities with the plants of neighbouring continents made out. I cannot think so if he will lend himself seriously to the work.

The general result which I draw from the whole flora is, that we have here a compound flora certainly two deep, possibly three deep. We have, in the first place, I believe, a genuine natural Atlantic, that is, European flora ; for in the face of the decided testimony to that effect given by the fauna I cannot accept Dr. Roxburgh's conclusions as to the supposed introduction and naturalization of every species having a European habitat. If they can be proved to have been introduced, good and well ; but I object to take the thing to be proved as part of the proof. And, in the next place, I believe we have the traces of an older African flora (why I call it older I will explain when I come to speak of an ancient connexion between Patagonia and South Africa) ; and I believe that both are due to actual continuity, however circuitous or interrupted, with the respective countries the impress of whose floras they bear.

Before leaving St. Helena, I have just one other argument to adduce in support of its former connexion with the other Atlantic islands, and that is the fact, which has only recently been ascertained, or, at any rate, only recently laid down in our maps, that there is a long band of elevated submarine bottom running north from St. Helena to the Cape-Verde Islands, and embracing in its course Ascension Island and the shoal ground on the equator.

The next trace of a microtypal element in the southern Atlantic is the island of Tristan d'Acunha; and in obedience to the natural train of thought, I shall begin with its flora, as I have just left that of St. Helena. I should have liked to have given in the Appendix a copy of the 'Flora St. Helenica,' partly in illustration of what I have said regarding it, and also for the purpose of contrasting it with a similar list of the flora of Tristan d'Acunha given by Capt. Carmichael in the 12th volume of the 'Transactions' of this Society; for we find the same elements in both,—a mixture of European and African types in nearly the same proportion. The St.-Helena list is rather long, and I hope may soon be supplied by a better; the Tristan d'Acunha list is short, and an abstract of it may be convenient, and one is therefore given. The only shrubby plants in the island (trees there are none) are *Phylica arborea*, and either one or two species of *Empetrum*. *Phylica* is an African genus represented by two species in St. Helena; and its occurrence in both St. Helena and Tristan d'Acunha furnishes at least a presumption in favour of the two islands having once been in communication with each other and with the African continent. *Empetrum* (our Crowberry), on the other hand, is, as every one knows, a most characteristic type of the Scandinavian flora, and not less so of the Magellanic and Antarctic Flora generally. So is the genus *Chenopodium*, wild species of which also occur in both St. Helena and Tristan d'Acunha. The genus *Pelargonium* has also species in both islands: it, notwithstanding the presence of a straggler in Syria, is unquestionably African, its species in that continent being numbered by hundreds. It seems of no consequence that, as Dr. Hooker informs me, the Tristan-d'Acunha species belongs to a different section from the St.-Helena species. We should have expected that they would be different; the greater the deviation the longer the probable period since they started from common parents, and the stronger the presumption in favour of my view of the connexion with Africa being very ancient. But what must strike every one most in running their eye over Capt. Carmichael's list is the resemblance to our own flora. We there see *Ranunculus*, *Rumex*, *Cardamine*, *Atriplex*, *Gnaphalium*, *Apium*, *Carex*, and similar genera.

Capt. Carmichael does not say much about the insects, but what he does say tells the same tale as the plants,—"Three small species of *Curculio*." Thus we have, again, small *Curculios*, probably similar to those which have given a character to the Coleoptera of the other islands; with them four *Phalænas*, the old genus for the typical British Moths—a *Hippobosca* (*qu' allait-il faire dans cette galère*, where were neither horses nor other land quadrupeds for them to feed on?),—two species of *Musca*, and a *Tipula*. Of Crustaceans, an *Oniscus*, an *Astacus*, and a *Cancer*, all characteristic types of the European fauna. Of the land-shells we may say the same; we know only two, both species of the genus *Balea*, a genus allied to *Pupa*, of which species have nowhere been met with elsewhere, except in Hungary, Norway, Porto Santo (one of the Madeiran group), and New Granada. The Norway species has also been found on the highest peak of Porto Santo. The only locality not entirely microtypal is New Granada; and of it the mountainous part is microtypal, the plain Brazilian. In which of these the *Balea* occurs I do not know; but the probability is in favour of the mountains, because the climate of the lower parts is so dangerous that it is almost entirely in the mountains that collecting has chiefly taken place.

The sea-shells and other marine objects recorded by Capt. Carmichael all have the same microtypal tinge. *Chiton*, *Cardium*, *Patella*, *Buccinum*, *Sepia*, *Echinus*, and corallines sound marvellously like the contents of one's basket after a rummage along the coast in our own country.

Have we now reached the southern limit of the ancient Atlantis? Is Tristan d'Acunha its outmost cape? Has it stretched for interminable space to the South Pole without leaving an indication of its existence? or has it trended off to the Falkland Islands and South Shetlands, and joined Tierra del Fuego, and possibly Patagonia? If there were no other way of accounting for the microtypal character of the fauna and flora of South America south of the Plata, all to the south of it being microtypal, one might feel disposed to assume that it did; and had we only the flora to go by, I should probably adopt that view, for we have in Tierra del Fuego and the other antarctic islands the very types of European plants that we have noted in Tristan d'Acunha—Empetrums, Ranunculus, Cardamine, Wild Celery, &c. &c. But I shall presently show that there was another route by which a communication between the arctic and antarctic hemispheres was effected, and that the affinities of the Coleoptera of Tierra del Fuego and Patagonia rather point to that being the channel of communication so far as they were concerned. It may probably have been the case that there was interrupted communication between Tristan d'Acunha and these antarctic islands, which in their turn had interrupted communication between Cape Horn, New Zealand, and Australia.

Leaving this question for future solution, I shall now revert to the European fauna, of which we have only touched on the most western limit, and trace it eastward. I have already said that the whole fauna from the Azores to Japan was one and the same. No better proof of this can be given than a comparison of the list of species from one end of the continent to the other. We have no complete lists of the Coleoptera all over the country, our lists of the east of Asia being comparatively imperfect, but they are still sufficient to illustrate the identity I desire to point out. We have a list of those found by Schrenck in Amourland and Eastern Siberia, made up by Motschoulsky, and published in Schrenck's 'Reisen im Amurlande'*. We have also some similar data regarding the Coleopterous fauna of South-east Siberia, collected by Raddé in his explorations; but this is very imperfect, and relates more to genera than species. Motschoulsky's list of species found both in Amour and Eastern Siberia contains 810 species. The portion of these found in Eastern Siberia is not, however, so applicable to my present comparison as the list of species found in Amour, which extends to the extremest limit of Asia. The number of species from it, enumerated in the list above referred to, was 340; but a fuller list was published afterwards by him†, which contained 564 species; and I have made it the basis of a Table, which will be found in the Appendix, from which the range of the species composing it can be ascertained. As it does not forward this inquiry to know what particular species are limited to Amour, I have left out all in that position, except when they represent a genus not otherwise present, when I give one species of the genus to show that it is present. I have also added a few on the authority of Raddé and others from South-east Siberia. The total number in my list thus purged and augmented is 382; but adding the number of the endemical species, of which I have not given the names, we start with 608 species known to inhabit the extreme east of Siberia.

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* I may here say, parenthentically, that Count Motschoulsky's tendency was certainly not to diminish the number of new species, but rather to increase them, so that any insect that he admitted to be the same as one previously described may, without much doubt, be accepted as really such.

† 'Catalogue des Insectes rapportés des environs du Fl. Amour, depuis la Schitka jusqu'à Nikolaëvsk, examinés et énumérés par V. Motschoulsky,' Moscow, 1860.

Of these the numbers are, in

Amour	579
Dauria	297
Western Siberia, or the districts of the Ural Mountains	227
North and Mid-Europe, as distinguished from East or West Europe	213
East Europe as represented by France and Belgium	184
Britain	133
The Madeiras	10
The Azores	7

To which I may add, in anticipation of what I must presently say in speaking of North America,—

On the western side of North America	8
On the eastern side of North America	23

The details will be found in Table VII. in the Appendix.

The diminution in identity of species as we go further from our starting-point (wherever we begin) and their replacement by new strains is, it will be seen, exceedingly gradual and equal, and the proportion of identical species persisting through the immense stretch of country embracing Asia and Europe very remarkable. But what is of still more importance in this inquiry is the identity of the genera. Using the word in its large sense, the same genera are spread over the whole region in question; used in the more restricted sense, adopted by modern naturalists, a similar replacement of one form by another allied one, which we have seen occur in species, takes place also in these groups of species. Thus, in recording the species from the Amour, Motschoulsky has thought it necessary to propose a number of new genera for the new forms; and the proportion of these to the old genera found there was about a fifth. He records 239 genera, of which 35 are new. And, curiously enough, this is very close upon the numbers which Wollaston has turned out in his work at the other end of the string on the Coleoptera of Madeira: he records 236 genera, of which 44 are new.

The same fauna goes southwards through Mantchouria and Korea into China; and about Shanghai we get to the line where it meets the Indo-Malayan fauna.

We have a tolerably fair (although far from complete) notion of the Coleopterous fauna of that part of China. Mr. J. C. Bowring procured important material from that quarter. Mr. W. W. Saunders has also made some of its species known; and latterly Mr. C. W. Goodwin, Assistant Judge of the Consular Court of Shanghai, has sent some important collections made in the immediate vicinity of that city to one of our London entomologists, M. de Rivas, who, I trust, will ere long give to entomologists a catalogue of the species. In the meantime these materials (which I have had the advantage of studying) show that the Coleopterous fauna of Shanghai is a mixture of a few Indo-Malayan types (such as *Copris molossus*, *Euchlora viridis*, *Cerosterna punctata* variety) with a mass of smaller species mainly belonging to the Europeo-Asiatic fauna; some identical with European species, the majority new species of the same type. A small collection of Coleoptera made by Dr. Collingwood at Formosa, which he has been kind enough to show me, exhibits the same mixed fauna, and of nearly the same kind and proportions.

An exactly similar intermixture occurs on the opposite coast of Japan; but what is most remarkable is, that although it occurs in the Beetles, Butterflies, Bugs, &c., it does not occur in the Hymenoptera. The great majority of the Beetles are of the Europeo-Asiatic type, and a certain proportion (as in Amour) are identical with, or only very slightly different from British species; the minority consists of species of the Indo-Malayan type, and indeed of the identical species which occur at Shanghai (*Copris molossus* and a variety of *Cerosterna punctata*, being two of the most prominent insects in both). But the Hymenopterous fauna is not of this mixed character; it is entirely Chinese. Mr. Frederick Smith, our first authority on the Hymenoptera, and who, from his position in the British Museum, has unusual opportunities of observing collections from all quarters, tells me that he has never seen a Hymenopterous insect from Japan of other than the Chinese type. It is the only class of insect, so far as I know, in which this deviation from the typical character observed in others occurs. Why should this be? Is there any peculiarity in the life of the Hymenoptera which can account for it? The only one I know of is, that one large section of them (the Bees) are dependent on flowers for subsistence in the larva state; and supposing the cold of the glacial epoch to stop the flowering of plants in Japan without killing the plants, the bees might be exterminated while the other classes still survived. Were Japan, therefore, separated from the mainland, so that on the restoration of a milder climate no fresh supply of species could be received from the north, and united to Southern China, so that it received its new inhabitants from it, and then finally separated from it as it now stands, we should perhaps have an explanation of the actual phenomena as regards bees; but there are other Hymenoptera to which this explanation will not apply, and further research may show that the exclusion of northern types is not so rigorous as at present appears. At any rate, it seems to me that if the whole earth might be replenished by chance colonization, then the presence and absence of particular classes of insects in Japan is without explanation.

I presume it will not be necessary for me to show that the same distribution prevails throughout Europe and Asia in every class of animals; Dr. Sclater was the first to do so in the birds, I have elsewhere done the same for the mammals. Dr. Günther has done it for reptiles, Gabriel Koch has done it for the Lepidoptera, Meyen and Hooker for plants. In fact every person is at one upon it, each in his own speciality.

The Europeo-Asiatic Beetle-fauna * does not stop even at Japan; it passes over into North America by Behring's Straits, or rather, I should say, it is found in North America on the other side of Behring's Straits. In Russian America we have a fresh crop of Europeo-Asiatic forms, genera and species; and here another noteworthy circumstance presents itself. It is generally taken for granted that there is a uniform homogeneous arctic fauna which extends all round the arctic circle. It is so, and it is not so. It is so on the large scale, but not so on the small. The arctic fauna is subject to the laws of spreading by continuity and stoppage by barriers just the same as any other fauna. I have elsewhere endeavoured to show that the mammalian fauna of Greenland is Europeo-arctic as distinguished from Americano-arctic. I maintain that the homogeneity of a fauna

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* I was unable, in my 'Geographical Distribution of Mammals,' to adopt Dr. Sclater's terminology of Palæarctic, Neoarctic, &c., because we did not agree in the extent and limits of our regions; and now, of course, in this paper I can still less do so, as a principal effect of my hypothesis, if it be sound, must be to still further break down their limits and destroy their solidity.

depends on other causes than uniformity of condition of life within its limits. I cannot doubt that if there had been an isolated communication between the Indo-African districts and the North Pole, we should there have had a fauna related to and developed out of that fauna, and wholly distinct from the other faunas of the arctic regions. It is continuity of soil or freedom of intercommunication which has produced the present uniformity of fauna in the arctic regions; but where minor interruptions exist, or old barriers or conditions equivalent to a barrier formerly existed, there are also subdivisions in the character of the fauna, and in the position of these minor divisions we see the operation of these laws and are able to trace the existence and former position of the barriers. Thus we find two minor subfaunas in Arctic America, an eastern and a western one. Two causes may have produced these. One of these may have been the sea which, it can scarcely be doubted, formerly existed between the Gulf of Mexico and the Polar Sea, in the line of the Missouri and Mackenzie rivers; another may have been that the ground now occupied by one of these subfaunas was under water at a later period than the other, so that it was peopled at a different date from it. Probably both contributed to produce the present arrangement of the subfaunas to the east and west of the Mackenzie River. That there was a barrier there, and that that side was still supplied with the same general type (though with minor deviations), is to be explained by their having received their species from the same general stock, but coming to it from different directions, the one from the east, the other from the west. That the minor differences to which I allude are, in the case of North America, to be referred to this cause, and not to mere gradual increase of variation arising from increase of distance, seems to be a legitimate inference from the fact that while the whole of the north of North America, without exception, belongs to the Europeo-Asiatic type, there are a number of European genera which occur in North-east America, and not in North-west, and *a few which occur in North-west, and not in North-east America.*

In the Appendix I have given a list of genera of Coleoptera which inhabit both sides of the Pacific, and do not occur in the Atlantic States of the American Continent, and also of a list of some species of other genera, similarly distributed. These are almost literally taken from my friend Dr. Leconte's Reports in the 'Pacific Railroad Reports,' 47th parallel, and on the Coleoptera of Kansas and Eastern New Mexico, as verbally corrected by him for me down to the most recent date, and only one or two being added by myself. Some of the genera or species in these lists may yet be met with in Eastern America; but after making allowance for this, enough would seem still to remain to warrant us in holding that a certain proportion of these must have reached America *viâ* Siberia, and that, in like manner, most of those in the Eastern North Atlantic States have probably originally come *viâ* Europe and Greenland.

North America has no special fauna or flora of its own. That which it has is a mixture of the microtypal and Brazilian stirpes intermingled with fresh importations of different dates, and modified by the advance and retreat of the glacial epoch; but, on the whole, the preponderating element in its fauna is the microtypal. What I am now pointing out with regard to Beetles may be traced to a greater or less extent in every branch of zoology and botany. I could go over each, pointing this out; but I will wait until the fact is disputed. Its origin is of very old date, the elements now respectively found in Europe and America having been already settled in each country before the Miocene time. Professor Heer's admirable papers on European fossil Tertiary insects give us the means of inferring this, and at the same time furnish arguments against his and Professor Unger's scheme of the Miocene *Atlantis*, which they held to have united Europe to America in the line of the Azores, and which, they think, served as a bridge for the intercommunication of the plants and animals in the two continents. That there was formerly a continent in the Atlantic is, I think, proved to demonstration by the facts already mentioned regarding the faunas of the Atlantic Islands. But that it reached America is gainsaid not only by the facts adduced in Professor Oliver's able paper on the subject, published in the 'Natural History Review,' and by those of other able naturalists, a *résumé* of which I have already given elsewhere ('Geographical Distribution of Mammals'), but by the examination of Heer's lists of species, to which I am about to refer. If the reader will turn to the Appendix, he will find in one of the Tables a list of all the genera of Professor Heer's 'Miocene European Coleoptera,' with the exception of a very few, which he could not refer to known genera, and which I have omitted. In that list I have noted in columns opposite to each genus the different countries in which they are now found ; and the result shows, first, that all these Miocene genera, excepting such as are universally distributed, are now confined to my microtypal regions; and, secondly, as regards Europe and America, that among them are plenty of genera which now inhabit both Europe and America, but not one that now inhabits America and does not inhabit Europe, while there are a few well marked and characterized forms, as, for example, *Pœlobius*, *Capnodis*, *Microzoum*, and some others of less marked distinction, as *Perotis* and *Eurythyrea*, which now inhabit Europe and do not inhabit America. This is as strong evidence in kind (I do not dispute that it might be stronger in quantity, that is in number of forms), but it is as strong in kind as a fossil collection from one country alone could give, that the same distribution which prevails in these two continents at the present time, prevailed already in the Miocene epoch. The genera which are now peculiar to Europe were then peculiar to it, and, consequently, the inference is strong that no communication between the two countries has ever existed since the days when these fossil insects were in life. If we had an American collection of the same age in which types now peculiar to America were found, the evidence would of course be still stronger, but it would be repetition of what we have already observed in Europe. The same relations between the American and European Miocene species are to be found in other classes. I give a somewhat less elaborate (as regards number of regions) list of the distribution of all the other existing genera of insects recorded by Heer and Krantz, not only for its bearing on this inquiry, but in the expectation that it may be convenient and useful to other students of geographical distribution to have such a list at hand. The Hemiptera have been gone over for me by Mr. Dallas, our first authority on that branch, and the table and notes embrace the information derived from him, although he is not responsible for it all, his attention having been only specially requested to Europe and America. In that table it will be seen that the Miocene genera *Prostemma*, *Nepa*, and *Diplonychus*, and in the Homoptera the genus *Tettigometra*, are now found in Europe and not in America, and that one or two instances where the reverse seems to be the case are due to modern alterations on the genera used by Heer. In the Diptera it will be seen that all the genera are both American and European.

The above are not the only points in which Professor Heer's Miocene species lend important help to the student of geographical distribution. They are of essential assistance in determining the southern limit of the microtypal stirps in Europe and Asia, and whether some of the forms which are found in the southern part of the European range really belong to it, or are immigrants from the African or Indian region lying to its south. The South-European fauna is composed partly of the same species as that of the districts more to the north, partly of distinct species of the same genera, and partly of what may be regarded as modified forms of the same general stock, but having a considerable effect in altering the facies of the fauna. Besides these, there are a few (perhaps in all not more than ten or twelve) species which have probably sprung from the African stirps, and established themselves in Europe by immigration. The southern limits of the fauna of this region, which extends along the bed of the Sahara onwards to the Caspian and Mongolian Steppes, are the deserts of the Sahara, which cut it off from Europe, and the Himalayan range, which divides it from India and China. As regards the Sahara, it is its southern border which is the limit. Its bed seems to have been raised by a force operating from the north. The strata, abutting on the Atlas mountain-range, rest inclined on its flanks as if tilted up by it. The effect of this elevating force operating in the north would, of course, be to raise the part of the Sahara nearest it first out of the water; the last vestige of the sea would be at the south, consequently the bed to the north would be first colonized, and it could only be so from the north. The facts of geographical distribution quite correspond with this view. The fauna and flora of the desert is Mediterranean, not Senegalese.

Returning to the Asiatic terminus of the microtypal stirps, let us now endeavour to trace its further course. The genus *Blaps*, which is a characteristic feature in the Coleopterous fauna of Central Asia, will furnish us with the means. It may be taken as a representative case applicable to other species also, although it certainly is the most striking instance which occurs to me. Upwards of 100 different species of *Blaps*, out of a total of about 150, have been described as inhabiting the country between Southern Russia, Mongolia, and Mantchouria. Now if we cross to California in continuation of the same line we have not *Blaps*, but we have *Blaps's* brother, and he has been a twin. We have

Eleodes, its perfect counterpart and representative; and it is to be observed that while the facies of the species actually inhabiting California is entirely that of *Blaps*, a number of species which are found in Kansas and on the eastern flanks of the Rocky Mountains have a somewhat different facies; and I should add that the supposition that these are stragglers from the Californian shores is strengthened by the fact that the genus does not occur to the east of the Missouri: other Heteromerous forms, reminding us of Mediterranean and Asiatic species, occur in California, and the whole of the north-west of America has a greater preponderance of the microtypal stirps than perhaps occurs east of the Rocky Mountains. The Brazilian element is less sensibly present, such Brazilian genera as *Passalus*, *Dynastes*, *Monocrepidius*, *Macrodactylus*, *Dichelonycha*, *Phanæus*, *Gymnetis*, &c. being absent in California, although present in the Eastern States. M. Candèze, in his work on the Elateridæ, notices that *Meristhus scrobinula* is found both in Mexico and China, and adds that he has found other species common to these countries, notwithstanding their distance from each other (Candèze, 'Elateridæ,' i. 165). Other facts in other branches of natural history lend strength to the idea of a former communication having existed between Asia and California. For example, in Mammals, there is a peculiar genus of Moles, *Urotrichus*, which has not been met with anywhere but in Japan and California. In plants, the botanist will remember that the Coniferous subgenus *Pseudostrobus*, so abundant in Mexico and California, in the Old World reappears in Japan, and only there. The Menzies and Douglas type of Spruces does the same, species almost identical with them occurring in Japan. The *Chamæcyparis* of California is only another name for the *Retinospora* of Japan; and among herbaceous plants similar relations can be pointed out. In the Sandwich Islands, again (so far as we know, which is not so much as we wish), which from their position may probably have been part of any northern land which formerly existed in the Pacific, as well as, at some period antecedent or subsequent, a part of Polynesia, the same character of fauna is present. Among the Lepidoptera we have *Sphinx cingulata*, Linn., or what is scarcely distinguishable from it, it in its turn being the scarcely distinguishable American representative of our own British *Sphinx convolvuli*. The only Coleopterous genera which I know from them are *Anchomenus*, *Colymbetes*, *Agabus*, *Hydrobius*, *Hete-*

rophaga, and *Dryophthorus* (*Calandra*), all of which are certainly microtypal.

Next step to the south of California comes Mexico. It also is largely supplied with *Eleodes*; and although some of the finest and showiest non-microtypal Coleoptera in the whole world come from Mexico, they have no bearing on this part of my inquiry; for they come from parts of Mexico which are in direct communication with another stirps, the rich Coleopterous fauna of Brazil and Venezuela; and the vast multitude of small European-looking species which occur on the high lands and western side is quite sufficient for my purpose. The collections made by Truqui in Mexico show this thoroughly microtypal character in a very marked way, Staphylinidous genera, such as *Falagria*, *Homalota*, &c., abounding. Mexico, being a sort of halfway house between Europe and Australia, might be expected to contain species both from the north and the south which have got thus far. *Eleodes* is an instance of this from the north, *Philonthus* another; both reach as far as Chili, but not into Australia. *Zopherus*, on the other hand, is an instance of a species which occurs in Australia, and runs up into Mexico, where it is in strength, and goes even a little further. Mexico may, indeed, have been its starting-point, but the connexions and relations of it and the allied genus *Nosodendron* decidedly indicate a separation between the eastern and western type of both; and the western type extends into Australia and New Caledonia.

Between Mexico and Peru, west of the Andes, there is a considerable space, as to which more information must be obtained in every branch of natural history before we can satisfactorily dispose of this question. There have been many collectors in it, but they have usually hurried to the interior and across to Columbia and New Granada; and I have seen no coast-collection of Coleoptera, nor do I know of any published lists. From the mountains themselves we have, however, received very considerable collections. Thanks to Professor Jameson, of Quito, we have a fair knowledge of the Coleopterous fauna of its neighbourhood. That of Bogota also is pretty well known. From these I can say that they consist of a mixture of microtypal with Columbian forms, in which the Columbian predominate; but the microtypal is represented by undoubted members of that stirps, such as *Graptodera*, *Philonthus*, small Harpalidæ, &c. Of other classes of animals the birds are best known, through the exertions of Messrs. Fraser and Salvin;

and, as it seems to me, there is a similar mixture of stirps in them. In such an inquiry as this, however, birds would require a special examination for themselves, their power of flight, and, still more, their migratory instincts, complicate their distribution so seriously. To do so fairly, the main distribution would require to be taken, in all doubtful cases, as the test of the stirps, leaving exceptional deviations out of view, whether they can be accounted for by exceptional causes or not.

Passing southwards to Peru and Chili, the number of Europeo-Asiatic genera diminishes, but the general facies still remains. The Chilian species in many cases belong to European genera, and the general facies is of the same character. *Blaps* still shows itself, only it has now passed out of the form of *Eleodes* into that of the smaller *Nycterinus*. The genus *Carabus*, which was lost in Mexico, has here retained its footing; it is found in great beauty in the Chilian Andes, although very limited in number of species. *Carabus* is a genus almost entirely confined to Europe, Asia, and North America. Africa proper has it not; India has it not; and, although it goes against my argument, I must in honesty add Mexico appears not to have it. St. Helena, the Chilian Andes, and Australia are the only places in the southern hemisphere where it occurs. In Australia the genus has undergone some modification (into *Pamborus*), and in St. Helena (into *Haplothorax*), but still true scions of the *Carabi*, and bearing all their facies. The *Feroniadæ*, too, which form a very characteristic element in the European and American faunas, are fairly represented in Chili, strong in Australia, and absent from Brazil, Africa, and India, except in places which of themselves suggest that they are emigrants from over the border. Such are the species in South America from the mountainous parts of Columbia, or in India from both sides of the Himalayas; *Pristonychus complanatus*, a European species, seems to beat all others in the possession of "an undergoing stomach to endure whatever may ensue." It occurs in Chili and also in the Canaries and in St. Helena. Another somewhat remarkable form is the genus *Thalassobius*, beetles which live under high-water mark; it belongs to the Trechidæ, which seem peculiarly adapted for trying strange modes of life, and peculiarly open to the impression of altered circumstances in them, turning into *Anophthalmi* of various kinds in dark caverns, into *Æpus* and *Thalassobius* under the sea. *Æpus* is the form they have taken under high-water mark on the coasts of Europe, *Thalassophilus* at Madeira, *Thalassobius* at Chili; and the late Mr. Wm. Sharpe Macleay informed me, in a letter written not long before his death, that he had found a similar species on the shores of Australia. Not then having my eyes open to the true significance of the occurrence of those species in these localities, I considered that probably they would be found on all coasts. I do not expect this now. I imagine they will be found confined to the coasts of the lands to which my microtypal stirps extends; and, in point of fact, they have not as yet been found anywhere else.

The distribution of the blind-cave Coleoptera is very remarkable. In the caves where they occur in Europe (chiefly in Carniola, Hungary, Corsica, and the Pyrenees) almost every new cave produces a new species closely allied to, but distinct from, those in the nearest caves; but more remarkable still, the Mammoth Cave of Kentucky produces a species of *Anophthalmus* so close to the Carniolan species that it is only on examination that one sees they are distinct. The *Anophthalmi* and their allies are carnivorous, hunting beetles, and, as I have just said, their parent type seems to be *Trechus*; but the same thing occurs with another totally different type, *Adelops*, a clavicorn allied to *Catops*. Not only in the different caverns and also under moss and in dark places do different species of this occur, but again in the Mammoth Cave of Kentucky it reappears side by side with *Anophthalmus* in an all but identical form there.

And here, while upon the cave-insects, I may remind the reader of the blind Reptilia and Crustacea of which allied forms occur in the European and American caves; and I would also draw their attention to a lately described form of cave-locustrian which has a distribution still more in accordance with the range of my microtypal stirps. One species occurs in caves in Europe, another in America, and a third in a limestone cave at Collingwood, Middle Island, New Zealand. They were at first described under different generic names, it being supposed, probably from the distance of their localities, that they must be distinct; but Mr. Scudder, the eminent American orthopterist, has shown that all three belong to one genus, which he has named *Hadenæcus*. Although they inhabit the deepest parts of the caves, they are not blind, but have the long legs which seem characteristic of the Anophthalmi and Cave-Araneidæ.

In the Elateridæ the characters are slender and often artificial, and so not well adapted for the elimination of questions of geographical distribution; but even in them we can satisfactorily establish the presence of the microtypal element in microtypal lands, and its absence elsewhere. Take the genus *Elater* proper. In it, of fifty-three species, twenty-three occur in the Europeo-Asiatic district, twenty-five in North America east of the Rocky Mountains, two in New Holland *, and if we unite to it the genus *Grammophorus*, which has quite the facies of *Elater* and stands next to it, we must add four from Chili.

In the Buprestidæ the genus *Stigmodera* is often quoted as a striking illustration of affinity of animal life between Chili and Australia. It is impossible to dispute the absolute identity of their type; they do not, however, pass further to the north than Peru.

Anthaxia is another type whose distribution corroborates my hypothesis. It is all but absent from Africa, India, and Brazil, or only very sparingly, and not very characteristically, represented by one or two species at the Cape of Good Hope or in the Malayan region; but in Chili it is so identical in appearance with our European species, that I remember when I first got some Chilian species I put them aside as obviously ticketed with an erroneous habitat. They also occur in Australia, although the species there are not so absolutely European in appearance.

A not less striking resemblance between Chilian and European species occurs in a heteromerous genus from Mendoza, at the eastern foot of the Andes (*Cacicus americanus*), which is so exactly a large counterpart of *Elenophorus collaris* from the Mediterranean, that I hold it to be perfectly certain that if both had been found in the same locality, only one genus would have been made for both. It is an out-of-the-way-looking genus, and no other example of the form occurs anywhere else on the face of the earth, so far as is yet known. The Scauridæ present similar South-of-Europe resemblances.

The Gallerucidæ, a family which is represented by different forms in the different regions where it occurs, are represented in the Europeo-Asiatic regions by the Halticidæ. These are very numerous also in Chili. The genus *Lithonoma*, of which only two species have hitherto been described (one from Spain), reappears in Chili, from whence I have received a species not yet described. In *Cryptocephalus* again, although the type leaves very little room for change in appearance, there is a certain difference between the Indo-African species and the microtypal. Brazil has only two or three of its own, and they have, to all appearance, been derived from North America or the west of the Andes. And there is again a difference between the European microtypal and the North-American microtypal, the latter having a facies of their own, which is shared by the Chilian and Peruvian species, and also in a less degree by the Australian.

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* One is recorded as having come from the East Indies, without more precise indication; but as that word generally includes the Himalayas, which are half Europeo-Asiatic, the locality cannot be counted either way.

In the Cassidæ we have the well-marked North-American genus *Porphyraspis* running down into Chili. In the Coccinellidæ, the *Hippodamias* (with the exception of one straggler in the Brazilian region, and one or two on its borders near Quito and Bogota) are entirely confined to the microtypal range, Chili being its southern limit, but it has not been met with in Australia. *Coccinella* proper, however, which has a similar range to *Hippodamia*, occurs there, and one or two stragglers have also found their way to the Cape, and one (*C. transversalis*) to the Malayan region.

The microtypal stirps in the southern extremity of South America is divided into two subfaunas by the Andes: that on their western flank is merely a continuation of the fauna of Western Peru; that on the eastern flank is cut abruptly off on its northern margin by the river Plata, where it meets the Brazilian type. The demonstrated history of this country sufficiently explains this distribution. Mr. Darwin in a few lines tells it thus: "The landscape has one character from the Strait of Magellan along the whole eastern coast of Patagonia to the Rio Colorado; and it appears that the same kind of country extends northerly in a sweeping line as far as San Luis, and perhaps even further. To the eastward of this line lies the basin of the comparatively damp and green plains of Buenos Ayres. The former country, including the sterile *traversia* of Mendoza and Patagonia, consists of a bed of shingle worn smooth and accumulated by the waves of a former sea; while the formation of the Pampas (plains covered by thistles, clover, and grass) is due to the estuary mud of the Plata deposited under a different condition of circumstances." (Darwin, Journal, p. 402.) In those days the water came quite up to the mountains on the western as well as the eastern side; for we learn from the same source that "the valleys in the Cordillera are filled with an immense thickness of stratified alluvium, which in all probability was accumulated at the bottoms of deep arms of the sea, which, running from the inland basin, penetrated to the axis of the Cordillera in a similar manner to what now happens in the southern part of the same great range."

There seems no reason to doubt that Patagonia and Chili were both supplied with their present faunas and floras from the main microtypal stock on the Andes. It is natural that from them the newly exposed sea-bottoms should have been peopled as they appeared, and quite in accordance with this that the stock flowing off to the right hand and the left should, while retaining a common character, have each respectively minor peculiarities. This is what we should expect, and this is what we find. In both we find the same forms of microtypal Carabidæ, *Cnemacanthus*, *Harpalus*, *Antarctia*, &c., the same modifications of Heteromera, as *Nyctelia*, *Cardiagenius*, *Praocis*, &c.; and in both the fauna, as a whole, is remarkably scanty.

In Patagonia, however, there occur one or two forms whose presence it is not easy to account for. The genus *Eucranium* occurs, not on the desert-plains between the mountains and the sea, but at Mendoza, at the foot of the eastern flank of the Andes, where the plains begin to rise into the desert base of the mountains; for notwithstanding the advantage of water from their snowy peaks, the coarser shingle at the base of the mountains maintains its sterility equally with that of the less-watered finer shingle at a greater distance from them. Now *Eucranium* is undoubtedly the representative of the Caffrarian genus *Pachysoma*, which is one of the Ateuchidæ, or pill-rolling beetles of Africa and India, the ancient *Scarabæus* of the Egyptians; and if this were a solitary case, I might perhaps have tried to get over it by arguing that although the *Scarabæus* is certainly an Indo-African form (being found both in India and Africa, and in preponderating numbers in Africa and all over Africa), it might yet have originally been microtypal because it is found in the Mediterranean district, not only in Egypt, Algeria, and Barbary, but also in Italy, Greece, &c., and from thence might have extended into Africa. But against this is the fact that *Ateuchus* is not found in Heer's lists of Miocene species, although *Gymnopleurus*, another pill-rolling beetle, whose distribution is similar to that of *Ateuchus*, is recorded there. The latter fact may be only an earlier instance of what has taken place in *Ateuchus*, or it may refer to some more ancient state of things; for all Coleoptera have no doubt been originally connected: but the connexion of *Ateuchus* with Europe is not the immediate point; it is the connexion between one of its

South-African peculiar forms and a closely allied form in Patagonia. Any doubt, however, that I might feel vanishes when I find other African forms or their representatives in Patagonia. In the Straits of Magellan has been found *Agrius fallaciosus*, a hunting carnivorous beetle, an undoubted relative of the South-African *Manticora*; and although cavils might be made against it on the score of the occurrence of one or two other allied forms in the continuation of the Andes in North America (*Amblycheila* and *Omus*), we have another stronger case still in the presence of the Rhea or South-American Ostrich. It could not be cast on the Patagonian shores by flotsam or jetsam, it could not fly over the intervening ocean; in fact, it is as strong a case implying actual continuity of soil as could be made up were one intentionally to try to contrive one. The concurrence of these three settles the point of their each being genuine instances of the presence of a South-African element only to be accounted for by continuity. The question then comes to be, Where and when did this continuity exist? As to the when, it seems clear that it must have been prior to the appearance of the Pampas and the plains of Patagonia above water. The specimens of *Eucranium* have all been obtained, not on the desert-plains or on their margin near the sea, but on the other inland side of these deserts at the base of the eastern side of the Andes, in the deserts of Cordova, in the neighbourhood of Mendoza. Both the African *Scarabæus* and its Patagonian representative are desert insects, and all Patagonia between the sea and the mountains is apparently sufficiently fitted for it; so that if it had arrived from Africa after the land had assumed its present configuration, it ought to have been found on the coast and on the plains rather than beyond them on the now dry shores of this ancient sea-bottom. I infer that it was there before the sea-bottom emerged, and has not yet spread far from the spot it occupied or escaped to on the occasion of that event. The reason why it has remained thus stationary, and not gone back as soon as it had the power, by the reappearance of dry land, into its former ground may be that its constitution had undergone a change when its conditions of life were altered. Perhaps until then it was a mere *Pachysoma*, as at the Cape of Good Hope, but under the new conditions changed into *Eucranium*; or it may be that in the struggle to obtain a footing on the reappearing land it was distanced by other species more speedy in their invasive movements or better suited to the locality.

I suppose I may assume that if the present position of *Eucranium* is due to a former union of Patagonia with Africa prior to its existence, the same conclusion applies to *Agrius* and the Rhea. We do not require a separate *Deus ex machinâ*, a separate junction of Africa and Patagonia for each of these desert species. Had any of them been of a constitution inconsistent with existence in a desert, we might have had to do so; but all three being by nature denizens of that kind of country, one explanation, one resource will do for all.

The next question in relation to them is in what direction the union of land lay by which the species travelled from Africa to South America, and by what route they reached their present locality. They may have come *viâ* the South Pole or Cape Horn, and having been established in a southern (now vanished) land, spread north to their present locality; or they have come in by Brazil and spread south to it; or their present habitat may be merely the inner margin of a wider former stretch of plains reaching all the way straight across the Atlantic. It may be that a former land once existed there where the plains of the Pampas now lie. The present Patagonia may not be the first of the kind, although the first of the name. This may be actually Patagonia the second, or, for aught we know, Patagonia the third. Mr. Darwin tells us of what must have been more than one previous Patagonia submerged and destroyed. "It required little geological practice," says he, "to interpret the marvellous story which this scene at once unfolded." (He is looking at some petrified trees on a bare slope of the Andes at an elevation of 7000 feet, near Mendoza.) "I saw the spot where a cluster of fine trees had once waved their branches on the shores of the Atlantic when that ocean (now driven back 700 miles) approached the base of the Andes. I saw that they had sprung from a volcanic soil which had been raised above the level of the sea, and that this dry land, with its upright trees, had subsequently been let down to the depths of the ocean. There it was covered by sedimentary matter, and this again by enormous streams of submarine lava, one such mass alone attaining the thickness of 1000 feet; and these deluges of melted stones and aqueous deposits had been five times spread out alternately. The ocean which received such masses must have been deep; but again the subterraneous forces exerted their power, and I now beheld the bed of that sea forming a chain of mountains more than 7000 feet in altitude." (Darwin, 'Journal,'

p. 406.) It was by that pristine Patagonia that these African relics must have reached their present place of abode, and it must have stretched out until it reached the Cape of Good Hope, sending out perhaps arms to Tristan d'Acunha and St. Helena, which, however, have the option of, what I think, a still more ancient union in another direction, as to which I shall have something to say when I come to Brazil and Madagascar. Judging from the character of the species preserved, we can guess at the character of the land uniting the two continents. It must have been a country much of the same general character as Caffraria, perhaps more flat and desert, and, like it, thinly clothed with vegetation. If it were not, then surely some trace of the African flora would have been left on the Andes. When it sunk again, all visible traces of its existence sunk with it, except perhaps the Rhea and beetles (and possibly one or two other animals which have escaped my recollection or, as yet, the researches of travellers) which happened to be left on the shore when the ground in front of them disappeared, the score or so of plants left on St. Helena and Tristan d'Acunha, and a slight sprinking of microtypal forms which still subsist at the Cape. That there should be such a trace at the Cape is, I think, essential to the hypothesis, always provided that the microtypal stirps had then reached the Patagonian Andes; for although from the physical nature of the country at the Andes a whole continent might sink out of sight quite up to its walls, carrying its population with it and leaving almost no trace behind, there is no similar barrier at the Cape. Some of the population of the submerged land must have either already settled in the country or escaped from their own land when it sunk. It may be that the microtypal stream had not yet reached Patagonia, that it arrived there, *viâ* the Atlantic islands, subsequent to this event. Mr. Darwin mentions that Mr. Brown determined for him the petrified trees above mentioned to be Araucarias; but this does not settle the question, for although coniferous trees are certainly microtypal, the Araucarias may have come from Brazil of an older date. I shall, under the head of Polynesia, notice the arguments, *pro* and *con*, as regards the character of the *Araucaria*. That Caffraria has a slight tinge of the microtypal element is certain; but it may have received it from Australia, as an affinity indicative of an ancient connexion between the Cape and the south-west of Australia has been sufficiently proved in plants, mammals, birds, as well as in insects. In favour of this Australian connexion having been the source of the microtypal Coleopterous element in Caffraria, it may be said that it seems to be most pronounced on the eastern coast of South Africa; against it that the element, if filtered through Australia, should have been more modified from the original northern type than it seems to be.

So far as regards the submerged Patagonian continent in question, I think we may, from the paucity of the traces left of its inhabitants, come to the conclusion that its duration, as compared with that of other continents, had not been long. It must have taken a long time for insects slowly to have spread from Africa to South America; but it seems to me that where there are no exceptional causes of fertility (as where a limestone or chalk sea-bottom was upraised, which I imagine, from being composed partly of organic matter, would be more speedily fertilized), where, for example, the bottom was sandy or shingly, as in Patagonia, or sandy, as in the Sahara, and where there is no water running through it, the process and rate of rapidity of clothing it with soil and vegetation must, *cæteris paribus*, be nearly the same in all, and that we may form an estimate of the comparative age of a country by the degree of fertility of its deserts. Thus I should suppose the Kalahari desert, which, although called a desert, is not wholly a waste, but studded with tufts of plants, must be older than the Salt-Lake deserts in North-west America, which are only beginning to get a widely scattered dotting of sage plants, and these deserts again to be older than the Sahara, which has no vegetation at all upon it. . It is true that the conditions of the Sahara are exceptionally unfavourable; but I take it there is some truth under the idea. So judged, the Patagonian continent could not have been proportionately far advanced, judging from its inhabitants, when it again sunk out of view.

Polynesia has hitherto been an entomological puzzle; and one of our most eminent British entomologists lately told me that after poring over the lists of its species and making them up into tables on various principles, he had at last been driven to the conclusion that they were composed of the sweepings of the whole world, and that there was no other way of accounting for them but by the supposition that the Pacific islands have had a dip under the sea long enough to kill all life, and that what was now found on it was derived from subsequent colonization after their reappearance, drawn, like its sailors, from all quarters of the globe.

Under my theory the Pacific Islands lead to no such inference. We must bear in mind that we have two distinct kinds of islands to deal with in the Pacific—the coral islands, like Keeling Island, the mountain-islands, like Tahiti. The coral islands are in the case described by my friend; the mountain-islands are not. What Darwin says of Keeling Island is no doubt true of all the coral islands:—"As these islands consist entirely of coral, and at one time probably existed as a mere water-washed reef, all the productions now living here must have been transported by the waves of the sea. In accordance with this, the flora has quite the character of a refuge for the destitute; Professor Henslow informs me that of the twenty species, nineteen belong to different genera, and these again to no less than sixteen orders"; and these nearly all "common littoral species in the East-India archipelago" *. The animals on that island were a rat, one or two wading or sea-birds (obviously stragglers), a small lizard, some spiders, and thirteen species of insects of different orders,—viz. of beetles, one minute Elater (the reader will remember that of the three beetles introduced in the Azores from Brazil, two were Elaters, the mode of their larval life in timber and the hard wire-like skin of these larvæ, as unsusceptible to wet as a duck's back, seeming favourable to their chances of successful transit); of Orthoptera, a *Gryllus* and a *Blatta*; Hemiptera, one; Homoptera, two; of Neuroptera, a *Chrysopa*; of Hymenoptera, two ants; of Lepidoptera, a *Diopœa* and a *Pterophorus*; of Diptera, two; and of these, without attaching much importance to it (as I admit that they are the product of chance introduction), I may still observe that, with the exception of *Blatta* (doubtless a naval *cadeau*), the whole, so far as named, are microtypal genera, a circumstance which ceases to be surprising if I am right in considering the non-coral isles of Polynesia as microtypal. I abandon the coral isles as "no man's land," but I claim as microtypal the islands which are composed of more solid stuff, especially those lying between Australia and America, and which are furthest from the influence of the New Guinea and Malayan subfaunas. It is from Tahiti and the Marquesas that the species of Coleoptera which we know from the eastern part of Polynesia have chiefly been obtained, from the New Hebrides and New Caledonia that we have received those from its western half. I shall take the eastern part first. Its microtypal character is thus well, although unconsciously, depicted by Fairmaire in his "Monograph on the Coleoptera of Polynesia" (Rev. Zool. 1849–50):—"In general, the Coleoptera of Polynesia have a facies by no means equatorial: although living under a burning sky, in the midst of a luxuriant and always growing vegetation, their colours are sad, and their bodies do not exhibit the large size, the varied form, the metallic lustre which we admire in the Coleoptera of New Guinea and the East Indies. A Buprestid of tolerable size, *Chrysodema Tayauti*, almost alone represents that tribe so numerous in New Holland and New Guinea; the Chrysomelidæ are reduced to two or three insignificant species" (Rev. Zool. 1849, p. 279).

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* Darwin's 'Journal,' pp. 541–543.

So much for the facies. The actual relationship of the materials composing it is shown in a Table in the Appendix, which I have made up from M. Fairmaire's work above cited, and in which I have marked the distribution of the different genera composing it.

From these it will be seen that not only a very large preponderance are of microtypal form, but that the fauna contains many genera which are familiar to the British entomologist as especially characteristic of the British subfauna, such as the genera *Anchomenus*, *Bembidium*, *Colymbetes*, *Agabus*, *Bolitochara*, *Placusa*, *Sunius*, *Leichenum*, *Anthicus*, *Ditoma*, *Cicones*, *Cerylon*, *Rhizophagus*, &c. The forms which have been borrowed from non-microtypal regions are not numerous; and there is no difficulty in indicating their source, the species being in many cases identical with that of the country from which it has come, a very common thing with introduced species, and which does not occur here with the microtypal species. In them the genus is the same, but the species is changed into new ones. It is this difference between recent immigrants and long-descended natives which generally renders lists of the distribution of mere *species* of so little value. They tell the tale of close vicinity, which we usually know without them, and of chance introductions, which throw no light on geographical phenomena; whereas lists of the distribution of *genera* speak of forms originally the same, but broken into new species by subsequent separation; and by their affinities we can trace their history much further into the past. In this concatenation the multiplication of genera on slight grounds is a serious obstacle to the study of geographical distribution. It injures it not merely by overburdening the memory with unnecessary names, but mainly by depriving us of reliable data for estimating the affinity of the inhabitants of different regions which we should otherwise have had.

I give a list of the known species contributed from other countries in the Appendix, from which it will be seen that they are derived as follows, viz. from

North America	2 timber species (common).
Brazil	3 timber species (common).
East Indies and Philippine Islands	4 timber species (2 microtypal and 1 carabid).
New Holland	2 timber species, 2 Heteromera, both microtypal, and 1 Staphylinid, microtypal.
New Zealand	1 timber species and 1 Staphylinid, microtypal.

And 1 cosmopolitan wanderer of doubtful origin.

Besides these, however, there are a number of types from these countries which have probably been introduced by nature without the help of man; for they are modifications of peculiar forms, and not actually the same; and whatever may be the alterations which change of climate has made within the reach of man's observations on species of the higher animals introduced by him, there is not the slightest ground for supposing that any change has been ever so produced in insects. It was, of course, only to be expected that there should be something of this sort from the East Indies. It is natural that there should be some overflow or some dispersal into a country so near; and in conformity with this we find the proportion of its overflowings diminishing as we recede from India. It is for this reason that I have in my Table above mentioned limited the list to Fairmaire's species from Central and Eastern Polynesia. Even that is divisible into two sections. Of the Eastern, M. Fairmaire says:—

"At Tahiti, where the temperature is very various, owing to the lofty mountains, where numerous streams preserve freshness, the species are more varied, the individuals in greater abundance, *Carabici* and *Brachelytra* are met with. The Sandwich Islands, which are situated to the north of the Equator, at the same distance as Tahiti is to the south, give almost the same insects in very small quantity."—*Rev. Zool.* 1849, 279.

Of the middle portion, again, he says, "At Tongatabou, a flat sandy soil, where water is rare at the surface, the *Carabici* and *Staphylinidæ* disappear, and in recompense the *Heteromera* appear in greater numbers, and some of the genera indicate, like the vegetation, an approach to Melanesia and Asia. It is the same as regards the Wallis Isles, the productions of which are almost identical with those of Tonga. In that western part we begin to find metallic colours, and generic types unknown to the eastern part, as *Amarygmus*, *Olisthæna*, *Mallodon*, &c.; but there remain still too many points of contact between these two zones to allow us to separate them distinctly."—*Loc. cit.*

The western islands have still more of this Indian element, as will be seen from the Table, which contains a list of the genera found by Father Montrouzier in New Caledonia. As my purpose is only to indicate the general character of the fauna of that part, I have not dissected it so minutely, but merely indicated the results. It will be seen from these that the microtypal stirps continues the staple, although a greater number of introductions from the Indian region and the Australian subfauna are visible. The most noteworthy of other alliances are those from South America; and perhaps the most interesting is the presence of a Firefly (*Photophorus*) in the islands (the New Hebrides) most distant from the South-American proper abode of the Firefly. The Glow-worm is a Miocene insect, and belongs to the microtypal stirps. The Firefly is neither. It is confined to the range of the Brazilian stirps. There ought to have been no Fireflies in my microtypal Pacific continent unless supplied from South America. There are other cases of a somewhat similar nature, in other branches, which will occur to the naturalist—for instance, the *Araucaria*, which, besides occurring in Brazil and Chili, is also found in the Pacific islands. This, indeed, is not so special a case; for Conifers being of old date in Europe, and in their associations and present distribution decidedly microtypal, the *Araucaria* in Chili and the Pacific islands may be modified descendants of the ancient European types, and the Brazilian species a straggler from them. The occurrence of the Tapir both in South America and the Malayan Archipelago points to a connexion between them at a comparatively recent date.

The other classes of insects, so far as I have gone into them, seem to me to corroborate the microtypal character of the Coleopterous fauna. As to the flora and avifauna I must, for the present, put them aside with those of Australia, with which they have considerable affinity and some identity.

New Holland is my next stage; and here I would first observe that the Coleopterous fauna of Australia, although recent discoveries show some modification and even a slight infusion of Malayan blood in the north, is as a whole homogeneous. In the next place, I do not anticipate any opposition to the general proposition that many of its ingredients, especially those in the south, have a European aspect. There are other elements which may very fairly form the subject of discussion whether they are derived from a microtypal origin or not; but as to the European affinity of a very considerable portion there can, I think, be no doubt. It will be sufficient to remind the entomologist of the genus *Pamborus*, the *Lebiidæ*, the *Broscidæ*, the *Feroniadæ*, *Haliplus*, the *Hydroporidæ*, the *Colymbetidæ*, *Gyrinus*, *Hydrophilus*, *Berosus*, *Arcticerus*, *Silpha*, *Nitidula*, *Soronia*, *Meligethes*, *Thalycra*, *Peltis*, *Hister*, *Morychus*, *Cucujus*, *Dendrophagus*, *Syncalypta*, *Ptinus*, *Trichius*, *Onthophagus*, *Aphodius*, *Lacon*, *Chalcophora*, *Lycus*, *Tenebrio*, *Anthicus* (of which there are 48 species already described from Australia), *Curculionidæ* allied to *Trachyphlœus*, *Lepyrus*, *Eurhinus*, *Otiorhynchus*, *Cryptorhynchus*, Longicorns (which, without being *Leptura* or *Rhagium*, are so like them that the names *Lepturoides* and *Rhagiomorpha* have been given them), *Haltica*, *Longitarsus*, *Hispa*, of the European type, *Coccinella*, &c., genera by far the greater number of which have no representative out of microtypal lands.

Even those forms which are usually considered typical of and peculiar to Australia, when carefully considered, lead to the same result. The *Anoplognathi*, one of the largest, showiest, and most brilliant metallic species in the country, belongs to a special group of Lamellicorns, which is well represented in Chili by allied forms (*Platycœlia*, *Brachysternus*, &c.); but it is still more closely copied in North America in what is there called the Goldsmith Beetle, *Cotalpa lanuginosa*; and if we pass on to Europe we do not, indeed, find it now, but we find fossil remains of it in the Miocene beds. The genus *Lamprima* is, at first sight, as peculiar as *Anoplognathus*, and equally restricted to Australia. It is little more than a metallic *Streptocerus*, a Chilian form, allied to *Scortizus*, which is not a very great deviation from the European and North-American *Platycerus*. I have a species (undescribed I believe) which has exactly the facies of an *Akis*, although systematists may insist on carrying it to *Adelium* or *Thoracophorus*. The Dish Beetle of the Australians (*Helæus*) looks as if nothing could come near it.

Examined, what is it but a modified *Cossyphus*? At the first glance, one would seek to place *Chrysolopus spectabilis* among the Diamond Beetles; at the second, among the *Aterpidæ*; but Lacordaire rightly tells us that both in character and habits it is only a magnified and abnormally decorated *Hylobius*. Another very characteristic Australian form is the genus *Paropsis*. But although almost confined to Australia, there are two exceptions, *Paropsis 12-pustulata*, Gebl., and *P. hieroglyphica*, Fab., both from Dauria, one of our microtypical countries, and one which, on any other other principle but that of my hypothesis, it seems difficult to connect with Australia. *Stigmodera* puzzles me as to its first origin more than any of the other peculiar institutions of Australia. It occurs in almost equal abundance and in still greater beauty in Chili, even showing itself by one or two stragglers in Brazil; and both its form and coloration are so close to those of our European and American *Ancylocheira*, which were already common in the Miocene epoch, that it is difficult to doubt that the one is a modification of the other; but then we have *Ancylocheira* proper also in Australia, the elongated form of *Ancylocheira*, which is found in California; and although that helps the microtypal list in one way, it rather militates against *Stigmodera* being descended directly from *Ancylocheira*. There is, indeed, nothing to hinder the species from having retained its type in part of the land and changed it another. On the other hand, however, *Stigmodera* can hardly be separated from *Temognatha*, certainly not in a derivative point of view; and *Temognatha* cannot be separated from *Julidimorpha*, and it is so like the African *Julodis* or *Sternocera* that it is difficult to believe that it does not contain some African black blood, communicated at the time when there was some connexion between the Cape of Good Hope and the south-west corner of Australia—a connexion which is recognized by all botanists, and whose traces are also discernible in all the other classes of organic beings, and which, as already said, may have been one of the means by which the Cape obtained the sprinkling of microtypal forms which is to be met with there. The Longicorn genus *Hesthesis* is now confined to Australia; but it is one of the European Miocene genera recorded by Heer. The genus *Chrysomela* is distinctly microtypal in its distribution, being, with a few easily understood exceptions, absent from India, Africa, and Brazil. One very distinct form of *Chrysomela* is the elongated forms which are so common in Switzerland (*Oreina* and *Entomoscelis*). In Australia these are represented by *Australica*, which repeats their markings. The genus *Galleruca* presents similar resemblances; I have a species from Port Phillip scarcely distinguishable from our British *Galleruca Nympheæ*. Of *Hispa* I only know two in New Holland; but one of these is very closely allied to the black species of Europe (*H. atra*, Fab.).

But it is not only in what it possesses that Australia shows its microtypal origin, but also in what it wants. In it we have no large Dynastidæ or large Lucanidæ, no Brenthidæ (notwithstanding the close vicinity of the New-Guinea and Malayan Archipelago, where they are so abundant) except a few species in the extreme north of Australia, obviously derived from the Malayan islands, no Sternocera, no Steraspis, no Psilopteridæ. In these and a multitude of similar *lacunæ*, the Australian fauna corresponds with that of the microtypal stirps in other countries.

The relative predominance of types is another, though a slighter, indication of relationship. If, for example, we take the whole order of Longicorns, we shall find a remarkable parallelism in the number of species in Europe and Australia. Professor Lacordaire, in the 8th volume of his ‘Genera des Coleoptères,’ has the following remark upon them. “The equality,” says he, “which exists in respect to numbers of species of Longicorns, between Australia, Europe, and North America, is remarkable. The first, according to Mr. Pascoe’s Catalogue, published two or three years since, had then 407 described species. Europe, according to Schaum’s Catalogue, had 412; and Melsheimer’s ‘Catalogue of North American Species,’ as published by Leconte, had 408.”

That a certain amount of infusion of New-Guinea and Malayan species should be found on the northern coasts of Australia was to be expected; but it is less, much less, than might have been anticipated, seeing that, from the shallowness of the Straits separating them, former union at some time or other might be predicated. I have already said that there is in some classes of animals and plants an affinity between the Cape of Good Hope and Australia. In the Coleoptera it is not very strong, but perfectly recognizable. For example, I think the characters, facies, and tuberculous covering of the Australian genera *Amycterus*, *Psalidura*, *Acantholophus*, and *Leptops* indicate affinity with the African *Somatodes* and *Hipporhinus*, of which latter, indeed, there are actually two species in Australia (as against seventy-six in

Africa); and the type seems to run on into Chili; for if *Leptops* is related to *Hipporhinus*, so is *Megalometis* (a Chilian genus) related, to *Leptops*.

A very remarkable African affinity in the Lepidoptera has been mentioned to me by Dr. Welwitsch. It is plain that an affinity to any genus endowed with peculiar properties is rendered doubly certain if the supposed allied species possesses the same properties. There is a Lepidopterous insect in Australia, the larva of which possesses remarkable poisonous powers. It has been named *Doratophora vulnerans.* Such insects also occur in South Africa. Livingstone speaks of a caterpillar called *Rigura* as producing fearful agony if a sore is touched with its entrails. Mr. Baynes, in his 'Explorations in South-west Africa,' speaks of another, or perhaps the same, which he calls the *Kaa,* and which is used as a poison for their arrows by the Bushmen; and Dr. Welwitsch had a personal experience of the severe swelling and pain in every part of his body which he touched with his hand after collecting specimens of a caterpillar against which he had been warned as poisonous. He had in consequence of the warning carefully avoided touching them, shoving them into a phial with a straw; but whether he had inadvertently touched them, or fingered the leaves on which they had been feeding (which he collected for examination), he and his servant were both laid up helpless for two or three days. His specimens of the caterpillar were lost; but among his Lepidoptera Dr. Fendler, of Vienna, who has undertaken a desciption of them, finds no less than four species of *Doratophora*; and these, doubtless, are the perfect insects of species of the caterpillar from one of which he suffered.

But although African affinities occur among the Lepidoptera, as among other classes, their character, as a body, is microtypal. I am not sufficiently a Lepidopterist to speak with any personal authority on the subject so far as regards minute distinctions; but I am sufficient of an entomologist to say that in the nocturnal Lepidoptera, especially those from Tasmania and South Australia, the facies is absolutely identical with those of this country, and many of the genera the same. Over the most of Australia diurnal Lepidoptera are extremely scarce; but the facies in them, too, is of the same character.

At the outset I admitted the wide difference between the present flora of Australia and our own microtypal flora; but I must not make the admission too unqualified; I must not lose sight of the beeches, the Frenelas, the Phyllocladi, which are of a different stirps from that of the rest of the flora of New Holland, a microtypal class of plants, too, that obviously connect New Holland with the microtypal lands of Chili and New Zealand.

The mammals and the birds of New Holland must, like the flora, be kept apart, and put in another category from the insects. How far this separation has to be carried in other classes, I shall not examine at present.

The Coleopterous fauna of New Zealand, although it has a somewhat different facies from that of New Holland, cannot be really separated from it. There are too many points of concurrence which can be accounted for only by a common origin to allow us to do so. The facies, although not quite the same, is in the same line, sombre, sad-coloured, small, or moderate-sized species. One very marked and distinct family of Carabidæ (the Cnemacanthidæ of Lacordaire, Broscidæ of Putzeys) seems conclusive as to the former connexion of Australia, New Zealand, Chili, and Patagonia—that of Chili and Patagonia more distant, and that of New Holland and New Zealand more intimate, and both characterized by a distinct section, which Castelnau has erected into a genus, named *Mecodema.* Putzeys, who has lately published a monograph of the whole family, looking only at the countries in which it is located, says truly enough, " the Broscidæ are represented in most regions of the globe;" but it is only another instance of microtypal being mistaken for cosmopolitan. Taking the continents of our modern maps as real regions, the family is represented most widely; but disentangling the localities and referring them to stirps, not a single species will be met with in the Indo-Malayan, the African, or Brazilian fauna, but the localities will be found to lie all in microtypal regions, and to be pretty generally and equally distributed over them all.

It may be instructive if I run over the genera of which the family is composed. Taking Putzeys's Monograph we have—

Broscus. Europæo-Asiatic.
Craspedonotus. Japan.
Mecodema. New Zealand.
Metaglymma. New Zealand.
Percosoma. Tasmania and Victoria.

Lychnus. Tasmania.
Oregus. New Zealand.
Promecoderus. New Holland.
Anheterus. Adelaide.
Adolela. Swan River.
Parroa. Swan River.
Cascelius. South Chili.
Broscosoma. Europe.
Miscodera. Europe and North America.
Baripus. Montevideo, Port Famine, Chili.
Cnemalobus (*Cnemacanthus*). Chili and Patagonia, one species extending into Bolivia.
Gnathoxys. Australia.

The family is apterous, so that no theory of dispersal by powers of flight will apply.

The *Hydropori* and *Colymbetidæ* of New Zealand are exceedingly similar to our species—one species so much so, that it has been supposed to be introduced. *Staphylinus oculatus* is close to the Australian *Staphylinus erythrocephalus*, which is also found there; and it may be noted incidentally that there is a greater resemblance between the latter and *St. variegatus*, from MonteVideo, than to any Chilian species. This may be a key to some date or order of events; but one such key is not enough to unlock the close-bound history of these former epochs. One or two very European-like Longicorns occur; and even those which seem most puzzling, if studied in relation to our own species, will, I think, be found to belong to the same type; for instance, *Hexatrichia pulverulenta*, Westw., is only an enlarged *Pogonocherus*, as is *Oopsis nutator*, from Polynesia; and *Pogonocherus* is surely microtypal. That some of the Longicorns have a relationship to those of New Guinea and the Indian Archipelago (*Tmesisternus*) is only what we might expect. I have had my attention drawn to a species which is described in the zoology of the 'Novara' voyage as inconsistent with my hypothesis—a species of *Acanthoderus*, a genus the metropolis of which is now Brazil. But, curiously enough, notwithstanding this, the genus *Acanthoderus* occurs in the Miocene beds of Europe, and three species still survive in the northern regions, two in Europe and one in North America. How the genus comes to be so strongly represented in the Brazilian fauna is another question. It may be a type of universal distribution, or it may be there as a representative of the microtypal element.

I now pass on to the Indo-African stirps. I may take it for granted that the East Indies south of the Himalayas, Siam, the south of China, and the Malayan Archipelago, all belong to one fauna or subfauna. It is not even possible to make subsections of any portion of them; not only the genera but even the species are often the same on both sides of the Bay of Bengal.

The only point on which I anticipate any difference of opinion in this direction is the relation of the New-Guinea group of islands to the Malayan group. As every one knows, Mr. Wallace has in various publications advocated a separation of the New-Guinea group from the Malayan by a line drawn up the Straits of Macassar, and has given a variety of interesting details in support of his views. Convinced by his reasoning, I adopted and followed his conclusions in my book on the 'Geographical Distribution of Mammals.' That was all right. The facts, so far as regards the Mammals, entirely supported Mr. Wallace's views, and I could do nothing else but adopt his hypothesis. I went rather further, however; I accepted his theory as of general application; and whether I have actually committed myself to that in so many words or not, I know I meant that, and I have no doubt that impression is given by what I say. I wish I had been a little more reticent; I now find, on a careful application of his hypothesis to Coleoptera, that it will not answer for them. Whether it be that we are dealing with creatures representing a more ancient state of things (the birds and mammals speaking to an arrangement of land and water at a comparatively recent period), or that we have overestimated the value of the differences of the fauna on each side of the Straits of Macassar, I do not know; but I do say, with a degree of positiveness and decision which, at any rate, must secure confidence in the strength of my own conviction, that the Coleoptera of the New-Guinea Islands are essentially Indo-Malayan. When I wrote my monograph of Nitidulidæ, I studied, as was my duty, the species collected by Mr. Wallace most thoroughly, and there was not a vestige of any element but the Indian element among them. So with the great mass of the rest. My friend Mr. Pascoe, who is our first authority on Longicorns, shares my opinion as regards them. There are undoubtedly a number of peculiar forms among the New-Guinea Coleoptera; but a few unusual forms in the face of thousands of allied forms would be a poor foundation on which to rest a distinct fauna. As a subfauna distinguished by the numbers of Anthribidæ, new forms of Brenthidæ, beautiful Tesosterni, &c., it may pass; but even then the line cannot be drawn, as in mammals and birds, with any sharpness. Australia, as it has been affected slightly by the vicinity of this Indian fauna, also has contributed a little of its own specialities to the nearest islands.

Mr. Frederick Smith's Table of the geographical distribution of the species of Hymenoptera collected in this archipelago by Mr. Wallace shows the same thing (Linn. Soc. Proc. vii. p. 109, 1864); and a still more striking result to the same effect would be exhibited if the genera were contrasted in the same way as he has dealt with the species.

The Philippine islands belong to the same group, although, like Formosa (which is on the boundary), they are probably not without a microtypal tinge. The *Pachyrhynchi* may fairly be considered to be representatives of the strictly microtypal genus *Otiorhynchus*.

Africa (south of the Sahara, of course) is better entitled to claim rank as a separate province than India. The general facies is different, the character and tone of the scenery is more decided—no doubt, owing to the difference in the conditions of each country, which has given greater predominence to one part of the same fauna in the one, and to another part in another. In Africa the great sandy deserts have encouraged the development of *Adesmia* and such desert-loving Heteromera, while in India there has been not only apparently a greater admixture of foreign elements, but in much of it, especially in the moist forest-overgrown island-mountains, there is no scope or suitable conditions for such species, but the other members of the fauna which flourish in wooded lands take their place.

One strong argument in favour of the original unity of the stock of India and Africa is that most of the genera which occur in the one country are to be found in the other when suitable conditions present themselves. It must always be kept in mind that while the presence of uncongenial conditions is a perfectly good explanation of the absence of any forms we might expect to meet, we have no right to expect something else to be there unless that something is a member, an ally, or a modification of something already in the fauna. Thus the absence of sandy deserts will account for the absence of *Adesmias*, but will not account for the presence of Brenthidæ, unless the Brenthid element were previously in the fauna; and so where, in a different country having special conditions, wholly new things are met with, the inference is that we have come into a new geographical region. Applying this to India and Africa, we can trace the concurrent existence somewhere or other of so many of the same genera in each, although certain elements preponderate in the one more than in the other, that it seems to me impossible to doubt that their origin is the same—that is to say, that before they were separated from each other the general type from which they have sprung was the same in both.

In my book 'On the Geographical Distribution of Mammals' I contrasted the genera which were present in Africa with those which were present in India; and the one list was almost a copy of the other. I did the same with the genera which were not found in Africa and those which were absent from India; and here again the lists were almost identical. Similar lists of the genera of Coleoptera present in, or absent from, the two countries give similar results. There is not space to make such an enumeration here; but I may remind the Entomologist of such characteristic genera common to both, and confined to both, as *Anthia*, *Ateuchus*, *Heliocopris*, *Goliathus*, *Heterorhina*, *Glycyphana*, *Popilia*, *Platynotus*, *Notocorax*, *Ceroplesis*, *Sagra*, &c. In many instances, too, where the genus is not confined to India and Africa, I think we may discern something in common between those species which come from these two regions. Thus in *Cicindela*, for example, a very common bond of union is the possession of white sutural lines or patches. In *Chlænius* the species with a narrow constricted thorax are mainly confined to these regions. The Platycorynus form of *Eumolpus* occurs in them, and in them only; so does the flat palmate expanded form of *Hispa*; and many more will occur to any one who searches for them.

The forms which are absent are scarcely less instructive than those which are present. There are, no doubt, many present in the one and absent from the other, whose presence or absence must be referred to dying out or first appearance after the separation of the two lands; but there are others which have a different significance. For instance, all the Staphylinidæ are very scarce in Africa. Through the kindness of my missionary friends I have received thousands upon thousands of Coleoptera from Old Calabar. For several years, while Mr. W. C. Thomson and the late Mr. Wylie were stationed there, I was in the habit of receiving large collections every year from that place; and yet during all that time and out of all that multitude I never saw a Staphylinidous insect among them. In other parts of the continent, where, as at the Cape, they have been exposed to microtypal contact they do occur, but in trifling numbers. Boheman mentions thirty-eight in his 'Insecta Caffrariæ.'' Natal and Mozambique supply a very few more; and Dr. Welwitsch found a few of the same genera in Angola. Now India is as poorly supplied with them as Africa; and the chief part of those found in both belong to such genera as *Pæderus*, *Osorius*, &c., which may possibly not be microtypal. But there are true microtypal species, both of Staphylinidæ and other groups, which are not found in India and yet occur in Africa, and which, I think, must therefore have been introduced subsequently to the separation of India and Africa, as, for example, *Aleochara*, *Cymindis*, *Anchomenus*, *Feronia*, *Bembidium* (see Boheman's 'Insecta Caffrariæ'), and various others, some of which will be found in the Table of the present distribution of Miocene genera given in the Appendix. There are three ways in which these may have made their entrance into Africa—(1) by Nubia and Abyssinia, (2) by the connexion with South-west Australia to which I have alluded, or (3) by the union with Patagonia, which I think can scarcely be disputed. One or two noteworthy peculiarities attend all these elements of mixture; viz. the comparatively small numbers of species which have succeeded in establishing themselves in the country or which have become generally distributed; the small progress which has been made by them in penetrating into it and getting away from their starting-point; and the absence of amalgamation with the original fauna on which they have been superinduced (which last is a strong argument against hybridization having any important part in the creation of new species). To these we must add, as obviously belonging to the same category, the remarkable disinclination or difficulty which one established fauna shows or finds to passing beyond its own limits into the territory of a neighbouring fauna, although the barrier which formerly separated them (and was the cause of them each having a distinct character) is now no more than an imaginary line. In Africa we can perfectly put our hands on the Abyssinian interlopers dropping in from the north-east, some, like plants and insects on Alpine mountains elsewhere, having got into positions where their retreat has been cut off by a change in the physical conditions of the country *. In like manner we can point out the Australian intruders at the Cape, the Cape element in Patagonia and without difficulty detect certain Brazilian settlers, which I shall presently mention as having made their way into West Africa. This, at first sight, seems difficult of apprehension and inconsistent with the wide spread of the very same species in other countries. Here are a few Staphylinidæ lingering at the Cape or at Angola without having succeeded in penetrating into West Africa, although, so far as we can judge, they have been there for many geological epochs; while other or the same genera of Staphylinidæ have in the short period since the retreat of the glacial epoch covered the north of Europe, Asia, and America with their hordes. There is something more here than mere physical barriers standing in the way of their dispersal. The explanation is simple: when the land fitted for their occupation is left free and unoccupied, as the northern half of Europe, Asia, and America was after the glacial epoch, the new comers cover the ground like wildfire, and the fauna and flora is rapidly established. When the ground is once occupied the case is different; every new comer meets the most stubborn resistance, the battle for life is resolutely contested, and the small proportion that we find established shows that few make good their entrance at all, and still fewer make any progress in their new land: and the truth may be that, instead of looking upon a scanty infiltration of an alien element into a land as an indication of its having been very ancient and almost washed away by repeated dilution (as we have generally been disposed to do), we should regard it only as an indication of a more recent attack on a well-garrisoned land which has successfully repelled the intruders. This is a consideration which throws additional light upon the enormous power and importance of the counterpoises of nature,—without them a land instantly taken up, with them the established order of things inpenetrable to all assaults—not an encouraging reflection to revolutionists, if the same rule prevails in the moral world which exists in the material world, which we cannot doubt to be the case. The students of geographical distribution may likewise

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* The Berlin Museum has obtained from Mr. Van der Decken's expedition, a true Carabus from Mount Kilimandjaro. It is the only Carabus that has yet been found in Africa proper, is peculiar in form (elytra swollen and rounded), but in other respects more in the direction of *C. alpinus* of Switzerland than any thing else. It is obviously a European form whose retreat has been cut off.

draw useful reflections from it, both general and particular. An important general reflection is that, whenever we see a homogeneous fauna (I am speaking of faunas, but the observation applies equally, or nearly so, to floras), we may rest assured that that is the first fauna which established itself after the land emerged from the sea and became capable of sustaining animal life, and that we must look upon all patches, encroachments, or overlayings of a different character, as attempts of some subsequent intruders to establish themselves among the older inhabitants. We see, too, how there is no inconsistency in a colony marching rapidly across a raised sea-bottom, while it is arrested the moment it reaches the other side. Coming to particulars, this may prove useful in sometimes helping us to a date. Thus we may argue from the faunas of India and Africa that these countries were once continuous and united, and that they were disjoined before the Cape received its contribution from Australia; for there are types common to Africa and Australia which do not occur in India.

The relation between the Coleoptera of Brazil and West Africa furnishes so very apt an illustration of the value of such indications, and the use that may be made of them in tracing the past history of geographical changes, that I may be excused anticipating a little what I have to say on the subject of these faunas.

A few years ago I read a paper to this Society, in which I pointed out the existence of the Brazilian element in Old Calabar. I believe that paper was closely scrutinized at the time (in fact, I know it was) by some of our best entomologists, who looked askance at it at first, but ended by admitting that I was right. Since then I have gone on, from time to time, describing the new species from Old Calabar in the 'Annals of Natural History;' and I do not believe there has been one of my papers in which I have not had to record the Brazilian element as again and again appearing. The same thing is observed at Senegal and Guinea, and Gaboon; and it has also now been recognized in the Lepidoptera also.

The evidence thus given of the presence of an important infusion of Brazilian type in the West-African fauna seemed to me sufficient to place the fact beyond dispute; and I would not now have troubled the reader with any further proof of it, had it not been for an expression of opinion which has fallen from our much-respected President between the reading of this paper and the printing of it, which shows me that I must not take this for granted; and the delay in printing this paper fortunately gives me the opportunity of supplying the want. Mr. Bentham, in his Annual Address, 24 May 1869, p. xciv, says:—

"Mr. Andrew Murray, in a paper on the Geographical Distribution of the Coleoptera of Old Calabar, in the twenty-third volume of our Transactions, as well as in his Monograph of Nitidularieæ, in the twenty-fourth volume, calls attention to a remarkable representation of Tropical-American types in Tropical Africa. I have myself on several occasions indicated a similar curious connexion in various vegetable types; and if we were to rely on these grounds alone, we might, with Mr. Murray, speculate on a former continuity between the two continents across the Atlantic. But, independently of geological arguments, such conclusions are much invalidated by facts since brought to notice, as, for instance, that some of these common types are also represented in Australia or other distant lands south of the Equator. The general features also of the vegetation of the two continents tend to the conclusion, more or less confirmed, I believe, in various zoological departments, that, from a very early period in the history of organic life, the broad Atlantic, from the southern tropic to far into the north temperate region, has been an impassable gulf for terrestrial organisms, except by such occasional waifs and strays as may result from actual means of dispersion."

Although neither by nature nor training at all disposed *jurare in verba magistri*, I candidly acknowledge that such an expression of opinion coming from one to whose judgment I, in common with all other naturalists, pay so much deference, satisfies me, not that I am wrong, but that my proofs are insufficient. I bow to his decision, lay fresh proofs before him and the reader, and ask a fresh judgment. In the Appendix I give a list of the genera of Coleoptera of Old Calabar with Brazilian affinities, so far as I have yet published them. I am not yet half through; but what is published may be taken as a type of what is to follow. I might have swelled my list by including *species* of universally distributed genera which were allied to Brazilian species of the same genera; but I have omitted them and taken only genera peculiar to the Brazilian stirps. The genera in this list amount to 21 out of 138, or about a sixth of the whole. Next, to make sure that I do not expose myself to the objection that "some of these common types are also represented in Australia or other distant lands south of the equator," I have endeavoured to make sure that none which I cite can come under that category; so that my argument cannot be touched by it. At the same time, I may say that I do not know to what species Mr. Bentham refers as falling under that category. I know of none. Lastly, as regards the opinion with which he closes, that "from a very early period in the history of organic life the broad Atlantic from the southern tropic to far into the north temperate region has been an impassable gulf for terrestrial organisms," I have only to say, "So be it, I do not dispute it." Carry back the date to as early period as you will; all I say is that at some period, and *that* a period subsequent to the appearance of the present forms of Coleoptera, the broad Atlantic was traversed, in at least two directions, and probably at three different times, by a stretch of dry land which united West Africa with Brazil, which united Patagonia with the Cape, and which, last of all and probably not without relation to the preceding, united Brazil with Madagascar.

At the outset I endeavoured to show the long-continued persistence of the present forms of Coleoptera; I pointed out that in the Miocene times they almost all come within our existing genera, that the same facies already existed in the Coal-epoch; and I do not suppose that Mr. Bentham or any one else will exact a higher antiquity for the Atlantic than that time; or if they do, there seems no reason why, since the forms of our Coleoptera have endured for so long a period, they should not stretch as much further back as any friend of the Atlantic may choose to carry its age.

On the strength, then, of the presence of the Brazilian types which I have shown to exist in West Africa, I think I am entitled to infer the former union of Brazil and that country. Now West Africa is almost entirely destitute of microtypal forms: there are a few; but their proportion is so trifling that it sufficiently indicates that they form no part of the original stirps, and are to be regarded as intruders who have made their way in from abroad. But if West Africa has little microtypal intrusion, no distinct fauna has more than Brazil; and it might reasonably be anticipated that, if the two countries had been united, a portion of the microtypal stirps would have filtered into West Africa through Brazil; but we do not find it to be so. Not only are there few microtypal genera in West Africa, but those which exist are not species whose origin we should think of referring to Brazil:

generally speaking, it is not difficult to suggest their source. This absence of microtypal Brazilian forms is shown in a remarkable manner by the Staphylinidæ, an immense family which, as I have already shown, is (with the exception of one small branch of it which has found its way into India and East Africa) now entirely confined to and very characteristic of microtypal lands. I have explained that that family is entirely absent in Old Calabar; and I believe it is equally so throughout West Africa. In the Brazilian district, on the contrary, it is widespread, and in some places abundant, especially Columbia and the districts adjoining the Andes. It would seem to follow from this, that the union between West Africa and Brazil must have existed and been brought to a close before Brazil itself received its microtypal element, at all events before it possessed Staphylinidæ, which seem to have been a late acquisition. There was thus a time when the Brazilian Coleopterous fauna was of pure unmixed type of the same character as that which it has communicated to West Africa; in other words, I have been right in classing the Brazilian as a great distinct stirps. That period must have been prior to its union with the rest of South America; for all round it is microtypal; and it must have been prior to its existence as an island, which, on other grounds, we know to have been a phase through which it passed. I have, in my 'Geographical Distribution of Mammals,' given a map which shows the form through which it probably passed when it and Venezuela and Guyana were islands—a separation which created subfaunas which still subsist, well marked and well defined, although the general type is unmistakably the same.

The way in which I read its history by these lights is:—first, that a great continent extended across what is now the Atlantic, from Brazil to West Africa, shut off by an ocean from the Andes or nearest land to the west (wherever that may have been), on the one hand, and from Eastern and Southern Africa, on the other; that this continent next sank in the middle and the Atlantic took its place; that, according to the laws of gravity and equilibrium, as its centre sank, its two ends and their shores rose, uniting West Africa to the rest of its continent, and Brazil to the Andes or western microtypal land. And as the sea-bed to the west became bare and dry, the Staphylinidæ and other microtypal forms rushed in from the west and the Brazilian types from the east; and, the ground being free, both established themselves together, under the law to which I have already referred as regulating the introduction of new species to new countries, viz. that if it be full, they make little way—if empty, rapid progress.

I make these flying shots at a covey of dates; not that I imagine that difficult problems like these are to be unloosed by crude generalizations from the few uncertain facts of doubtful import which we possess, but as illustrations of the kind of use to which some of the principles which I see only dimly looming through the haze, but which I do believe to have truth and substance in them, may be put when we have got more facts and know better how to use them. One fact seems to shine clear out of the mist; and that is that in all those countries where different types have made good their footing, the races seem to preserve their identity for all time, mixed but never blending, approximated but never amalgamated. If hybridism be an agent at all in the production of new species, it certainly carefully confines itself to its own type.

The islands in the Indian Ocean between India and Africa (Mauritius, Réunion, &c.), exclusive of Madagascar and its immediate dependencies, are partly Indian, partly African and Malagasse. Madagascar is a land of wonders, not only for what it contains, but for its relations with other countries. The basis of its fauna is African; but it has also elements of its own, some of which may be traced far off, and in countries which have lent it something in return. We do not yet know how these peculiarities are distributed in the island. One collector goes to Madagascar, and he finds little or nothing but common African forms. Another goes to some other part of the island (some of them, especially the older ones, have not been so particular as we now find it necessary to be in reporting the localities searched and their products), and he sends home the most wonderfully attractive and strange forms it is possible to conceive. A double fauna is certainly represented there—one African and the other American—some have said allied to North America, others to Mexico, and others to Brazil. It is a slight tincture of the Brazilian stirps which is found in all three. The African connexion will, I dare say, be admitted. The Brazilian is proved by the presence in Madagascar of various representatives of Brazilian forms. Thus *Polybothris* represents the Brazilian *Psiloptera*; *Doryscelis* represents *Gymnetis*; *Stigmotrachelus*, *Platyomus*; *Peltis Ivanii* is found in both; but by far the most convincing instance is a moth of the genus *Urania* (to my mind, the most gorgeous Lepidopterous insect in existence). It is an unusual thing at any time to meet with a gay-coloured moth; but one with metallic brilliancy is still rarer: *Urania* exceeds any thing I know in this respect; and it stands *per se*, nothing else like it in any other genus. Of this genus there are six species—one in Madagascar (*Urania Ripheus*), and the other five within the range of the Brazilian fauna, viz. two in Brazil (on the Amazons), another in Venezuela, one in Cuba, and one in Jamaica. *Stelidota octomaculata* is an example of affinity with North America. The mammal *Solenodon* of the West Indies has been claimed as allied to the Madagascar *Centetes* (this, I think, on insufficient grounds); but Madagascar is the only place where (with one exception) Iguanoid lizards occur out of America, and the only place in the Old World which furnishes examples of the American Colubrine forms *Xiphosoma* and *Heteroda*. The Lemurs, too, as I have elsewhere argued, are perhaps more nearly related to the Opossums or Squirrels than to the Monkeys; and if it be to the Opossums, that would be a link the more with Brazil. It is to be observed that all these affinities are confined to Madagascar and do not touch South Africa. According to my views, they are insoluble except by the supposition of a dry-land communication between Madagascar and South America. My conjecture is that when the communication between Patagonia (the penultimate) and the Cape was interrupted by the sinking of the land, all the land did not sink. The ground now occupied by Patagonia did sink; the land next Africa also sunk, but a mountain-range survived running from Cape Frio (Rio Janeiro) obliquely across the Atlantic to a point a little to the south of the Cape of Good Hope, there rounding the Cape and running up to Madagascar exactly in the shortest line that a ship could sail directly from Rio Janeiro to Madagascar. It may seem too child-like and direct to the purpose to propose such a route; I felt it so until I studied the sea-bottom, when I found that there a broad raised ridge does run along the bottom of the sea exactly in the direction I have laid it down. I was not aware of this until I saw it so mapped in a map of the bed of the Atlantic in Mr. Keith's Johnston's New Physical Atlas. No one will dispute the importance of the configuration of the bottom of the sea as an indication of the line of ancient continents; and on the strength of this and of the fauna of Madagascar, I think I have very fair grounds on which to base my hypothesis. Being a ridge, it would continue so when above water, and not appear as a plain like the desert Patagonian junction, but a mountainous or hilly country which would be watered by streams, clothed with forests and fitted for the habitation of such sparkling creatures as the *Urania*; for we see that nature always assimilates the aspect of the inhabitants of a country more or less to its prevailing hue; and where forests and flowers and dewdrops abound, there she clothes them in her most gorgeous robes.

It may be that the last scene of all of this strange eventful history, prior to the appearance of the land as it now stands, was the extension of the microtypal regions of Cape Horn out to Kerguelenland, whereby the antarctic islands had already received their present flora, an extension which must have subsisted until a comparatively recent period, at least subsequent to the glacial epoch; otherwise I do not see how these islands could have been redintegrated in the possession of their flora after the retreat of the ice. As regards the bridge or range to Madagascar, that must have been its last scene; for otherwise we should not have it preserving its position and contour at the bottom of the sea.

Africa itself is not difficult to read. Subject to the modifications of which I have been speaking, the whole of the eastern half of the continent is one broad band composed of one fauna.

Lay a parallel ruler on the map, with one limb along the east coast and the other limb drawn back as far west as Congo on the west coast, and you have the region I refer to pretty fairly marked out. It includes Abyssinia, Somali-land, Mozambique, Natal, the Cape, Namaqua-land, and Angola. A succession of great lakes and deserts is known to mark out part of the western margin of this region; to the west of it, or rather of the barrier so composed, we have what I may call an island surrounded by a nearly dry ditch, viz. the unknown region between Gaboon and the Congo on the south, a moat only partially supplied with water, the Albert-Nyanza line of lakes on the east, the Sahara on the north, and the Atlantic on the west. The countries of which this island is composed are, Senegal, Guinea, Old Calabar, and Gaboon. While it has a large share of the general African element of the eastern side of the continent, it has also specialities of its own, and superinduced upon it the very perceptible flavour of Brazil of which I have already spoken.

In fixing the southern limits of this South-American element in West Africa, I have been guided partly by the descriptions of the Coleoptera of Angola, published by Erichson in Wiegmann's 'Archiv,' in 1848, as corrected by Wollaston's removal of the Cape-Verd species, which the death of the collector, Grossbentner, had occasioned to be confounded with the general Angolan collection, and partly by the collections made by Dr. Welwitsch. The Fellows of the Linnean Society know Dr. Welwitsch chiefly as a botanist, or, perhaps, through his and M. Morelet's recent work 'On the Mollusca of Angola,' as a conchologist. But his entomological collections are not less admirable in every respect than his botanical; and through his liberality and kindness I have had the advantage of studying in them an amount of material greatly exceeding in extent the collection described by Erichson. From it I am enabled to say that the Brazilian element does not come south into Angola. The type of the Angolan Coleopterous fauna is Caffrarian beyond any question.

The Brazilian stirps should alone now remain to be treated of; but in speaking of other regions I have already said by anticipation every thing that I have to state regarding it.

There is one point, however, on which I have a general remark to make, which is also specially applicable to it. In Columbia and some of the border-lands nearest the microtypal stream in the Andes we see many fine, rich, glowing metallic species, which, from their size and beauty, we are naturally led to refer to the Brazilian stirps, but which in reality belong to genera which, without doubt, are naturally microtypal, as *Harpalus*, *Philonthus*, *Xantholinus*, *Staphylinus*, &c. When we have to determine to which stirps such species belong, we must discriminate between the natural brilliant elements of the Brazilian fauna and the superadded brilliancy developed upon microtypal forms by the special conditions of the locality. Columbia and Ecuador abut on the eastern margin of the microtypal range in Equatorial America, and a modification of the stirps is to be expected there. Mexico, Central America, the West Indies, New Granada, Columbia and Ecuador, Cayenne, and in some cases even Venezuela are to be regarded as debatable lands, in which the true character of the stirps to which the species inhabiting them belong is to be determined, not by the place in which they are found, but by a sound consideration of their affinities and distribution elsewhere.

APPENDIX.

TABLE I.—Showing the actual present distribution of the following existing genera recorded to have been found in the Miocene beds of Oeningen, Radoboj, Rott, Aix in Provence, and Iceland.

EXPLANATION.—A single asterisk means that the genus occurs in the countries indicated by it.

A double asterisk that it occurs in force.

Where numbers are given, they indicate approximately the number of species known to occur in the country in question (note 1).

1. *Coleoptera.*

Genera.	Microtypal stirps. (*note* 2)								Debatable lands.			Brazilian stirps.	Indo-African stirps.			
	Europe.	Asia.	N.-E. America.	N.-W. America.	Chili.	Australia.	New Zealand.	Polynesia.	Between N. and S. America.	Between Asia and India.	Between Europe and Africa.	Brazilian region.	India.	W. Africa.	S. Africa.	Madagascar.
Cymnidis	30	36	34	4	3	3	...	...	9	1	2	...	...	..	2	
Brachinus	**	**	**	*	*	...	...	...	*	......	*	*	*	*	*	
Anchomenus (*note* 3)	42	35	61	13	12	3	3	4	5	......	......	12	...	3	3	
Feronia (Argutor)	**	**	**	*	*	**	*	*	*	......	......	*	*	?	*	*
Harpalus	**	**	**	*	*	*	...	*	*	*	......	*	?	*	*	*
Bembidium	**	**	**	*	**	...	...	*	*	......	......	...	...	*	*	
Palæobius	*															
Agabus	**	*	**	*	*	...	...	*	*	......	......	*				
Colymbetes	**	*	**	*	*	*	*	*	*	......	......	...	...	...	*	
Dytiscus	**	*	**	*	...	*	*	...	......	......	......	*	...	...	1	
Hydrophilus	*	*	*	*	...	...	...	...	*	......	......	*	*	...	*	*
Hydrous	*	*	*	*	*	...	...	...	*	......	......	*	...	...	*	
Hydrobius	*	*	*	*	...	*	...	*	......	......	......	...	...	...	*	
Philhydrus	*	*	*	*	*	...	...	*	......	......	......	...	...	*	*	*
Laccobius	*	*	*	*	...	...	...	...	......	......	......	...	...	...	*	
Ochthebius	19	...	2	3	...	...	...	...	......	......	......	...	...	...	1	
Tachyporus (*note* 4)	**	*	**	...	*											
Philonthus	**	**	**	*	*	*	*	*	*	......	*	*	*	...	*	*
Staphylinus	24	15	8	5	?	2	1	1	8	1	......	58	1	...	10	1
Xantholinus	*	*	*	...	...	*	*	...	*	......	*	*	*	...	*	*
Lithocharis	*	?	*	...	*	...	...	...	*	......	......	*	...	...	*	
Sunius	*	...	*	...	...	...	...	*	*							
Stenus	**	*	*	...	*	...	...	...	*	......	......	*	...	...	*	*
Oxyporus	*	...	*													
Anthophagus	*	...	*	*												
Omalium	**	*	**	...	...	...	...	...	*	......	......	...	...	...	*	

1. *Coleoptera* (continued).

Genera.	Microtypal stirps.								Debatable lands.			Brazilian stirps.	Indo-African stirps.			
	Europe.	Asia.	N.-E. America.	N.-W. America.	Chili.	Australia.	New Zealand.	Polynesia.	Between N. and S. America.	Between Asia and India.	Between Europe and Africa.	Brazilian region.	India.	W. Africa.	S. Africa.	Madagascar.
Scaphidium	*		*	*					*			*			*	
Amphotis	*	*	*													
Peltis	*	*	*	*		*							*	*	*	*
Corticaria	**	**	*	*			*									
Trogosita	*	*	*	*				*								
Dermestes	*	*	*	*	*	*	*	*					*	*	*	
Byrrhus (*note* 5)	*	*	*	*											*	
Gymnopleurus	*									*	**		**	*	**	
Onitis (*note* 6)	*	*	*			*				*	*		*	*	*	
Onthophagus	**	*	*	*		*			*	*	*	*	**	*	**	*
Aphodius (*note* 7)	**	*	*	*	*	*		*	*	*	*	*	*	*	*	*
Melolontha	*	*	*	*									?			
Rhizotrogus	*	*									*				*	*
Anomala	*	*	*	*	*	*			*		*	*	*	*	*	
Anoplognathus (*note* 8)			*		*	*										
Pentodon (*note* 9)	*	*	?													
Trichius	*	*	*						*							
Capnodis	*	*	*													
Perotis	*															
Ancylocheira (*note* 10)	*	*	**	*		*									*	
Eurythyrea	*	*						*								
Dicerca	*	*	**	*												
Sphenoptera	*	*				*									*	
Agrilus	*	*	*	*	*			*	*		*	*		*	*	
Ampedus (*note* 11)	**	*	**	*	*	*			*							
Ischnodes (*note* 12)	*		**	*									*	*	*	
Cardiophorus (*note* 13)	*	*	*	*		*				*	*		**	*	**	*
Diacanthus (Corymb. Cand.)	**	**	**	**		*	*			*					*	
Limonius	*		**	**					*	*						
Lacon	1	2	2			13			6	1			33	3	9	23
Adelocera	7	2	4	1	1			2	4			6				3
Luciola	**	*	*			*		*			*		**	*	**	*
Telophorus (*note* 14)	**	*	**	*	**	*		*	*	*	*	*	*		*	
Malachius	**	*		*	*										*	
Clerus (*note* 15)	*	*	**	*	*	*			**			**	*	*	*	
Ptinus	**	*	*		*	*	*		*			*				*
Cis	**	*	*	*					*		*	*			*	*
Lytta	9	18	40	24	6				8		1	48	8	15	11	
Meloe	*	*	*	*	*				*					*	*	*

1. *Coleoptera* (continued).

Genera.	Microtypal stirps.								Debatable lands.			Brazilian stirps.	Indo-African stirps.			
	Europe.	Asia.	N.-E. America.	N.-W. America.	Chili.	Australia.	New Zealand.	Polynesia.	Between N. and S. America.	Between Asia and India.	Between Europe and Africa.	Brazilian region.	India.	W. Africa.	S. Africa.	Madagascar.
Cistela	*	*	*	*	...	*	...	...	......	......	......	...	*	*		
Mycterus	*	...	*	*												
Gonocephalum (*note* 16)	*	*	*	...	...	*	...	*	......	......	*	?	*	*	*	
Microzoum	*															
Boletophagus (*note* 17)	*	*	*	...	*	*	*	*	......	......	......	...	*			
Uloma (*note* 18)	*	?	*	?	*	...	...	*	*	......	......	...	...	*		
Platydema	*	*	**	*	*	*	...	*	*	......	......	**	*	*	*	*
Myodites	*	...	*	*	...	...	...	...	......	......	......	...	...	?		
Urodon	*	...	...	...	...	...	...	...	......	......	......	...	...	*		
Choragus	*															
Bruchus	*	*	*	*	*	*	...	...	*	......	......	*	*	*	*	
Rhynchites	55	12	3	1	2	...	...	...	23	......	......	9	3	...	5	
Apion (*note* 19)	322	11	13	8	3	...	...	1	26	......	......	17	18	...	11	
Brachycerus (*note* 20)	41	5	...	...	...	...	...	...	......	......	......	...	1	3	186	3
Hipporhinus (*note* 21)	...	...	...	...	...	2	...	...	......	......	......	...	...	...	76	
Sitona	100	3	2	6												
Hylobius	22	3	5	?	...	1	...	...	......	......	......	3				
Cleonus	240	35	2	...	...	...	...	...	......	......	......	...	4	12	15	
Larinus	97	5	1	...	...	...	...	...	......	......	......	...	...	1	7	
Lixus	150	6	8	16	7	1	...	...	5	......	2	7	7	10	30	5
Rhinocyllus	6															
Phytonomus	149	8	2	3	...	...	...	...	......	......	......	2	...	1	3	
Cryptorhynchus	5	4	11	10	6	6	...	8	33	......	......	93	9	8	2	2
Magdalinus	50	...	6	2	...	1	...	...	......	......	......	3				
Tychius	88	4	3	...	4	1	...	...	......	1	......	1	...	1	4	
Acalles (*note* 22)	95	1	1	...	19	6	...	11	3	......	......	8	1			
Ceuthorhynchus	**	**	*	*	*											
Nanophyes	25	...	...	...	...	1	...	...	......	......	......	...	...	...	2	
Sphenophorus	14	2	27	15	10	2	...	3	46	......	......	15	13	4	8	
Cossonus (*note* 23)	**	...	*	*	*	*	...	*	*	......	......	*	*	*	*	
Hylesinus	*	...	*	...	...	...	...	...	......	......	......	*	...	...	*	
Clytus	*	*	**	...	*	*	...	...	*	*	......	*	*	*	*	
Mesosa	*	...	*	*												
Acanthoderus	*	*	*	*	*	...	*	...	**	......	......	**				
Lamia (*note* 24)																
Saperda	*	*	*	*	...	*	...	*	......	......	......	*	*	*		
Dorcadion (*note* 25)	*	*	...	...	?	...	...	...	*							
Hesthesis	...	...	...	...	...	*										
Donacia (*note* 26)	**	**	**	*	...	...	...	...	......	......	......	...	*	*		

1. *Coleoptera* (continued).

Genera.	Microtypal stirps.								Debatable lands.			Brazilian stirps.	Indo-African stirps.			
	Europe.	Asia.	N.-E. America.	N.-W. America.	Chili.	Australia.	New Zealand.	Polynesia.	Between N. and S. America.	Between Asia and India.	Between Europe and Africa.	Brazilian region.	India.	W. Africa.	S. Africa.	Madagascar.
Labidostomus	*	*														
Cassida	46	11	4	1	2	8	...	...	3	3	......	7	27	25	40	5
Lina	*	*	*	...	*	...	...	...	*	......	......	...	*	...	*	
Plagiodera	*	...	...	...	...	...	...	...	*	......	......	**	*	*	*	
Chrysomela	*	*	*	...	...	...	...	...	......	......	......	...	*	...	*	
Oreina	*	*	...	...	...	*										
Gonioctena	*	*	*	...	...	*										
Coccinella (*note* 27)	**	**	**	*	*	*	*	*	*	*	?	*	*	...	*	*
Lasia	*	*														

Notes to 1. *Coleoptera.*

Note 1.—This Table is made up to show the distribution of particular forms. On this point, the relative number of species is a secondary consideration; and even were it not so, we could not use it; for the statistics we have are, for any purpose requiring accuracy, wholly unreliable, from insufficient exploration and imperfect knowledge of the contents of different countries, from unnatural dismemberment of forms into new genera, and from the inaccuracy or carelessness of describers, who, besides describing, as new, species which have been already described, have multiplied or diminished the number of species, each according to his own notions of what constitutes a species. To say nothing of the number, however, might sometimes lead to an undue idea of the strength of representation of the same genera in different countries; I have therefore occasionally added the approximate numbers of the species known in each district, when it could be done without much trouble and with some approach to accuracy. Where I have not given the numbers I have marked the districts where the genus is strong by a double asterisk, where weak by only one. My numbers, where given, have no pretence to more than a general approximation: for my purpose this is enough; and I believe they will be found sufficiently near to answer it.

Note 2.—The geographical regions in this Table are:—

1. Europe, including the Mediterranean district, North Africa as far south as the southern margin of the Sahara, Syria, Asia Minor, and the shores of the Black Sea.

2. Asia, north of the Himalayan range, from the Ural mountains and Caucasus eastward to the Pacific.

3. North America east of the Rocky mountains.

4. North-west America from Behring's Straits to Mexico.

5. The Chilian region, including the whole of South America to the west of the Andes, the part of Peru in the Andes, part of the South of Bolivia, and the western and southern part of Paraguay, also La Plata, Patagonia, and Terra del Fuego.

6. Australia, including Van Diemen's Land. I should have wished to divide Australia into the northern and the southern halves; but as yet our materials are insufficient to allow this to be done. More attention is now bestowed on localities; and I trust it will not be long before we can fairly allot the different portions of the Australian fauna.

7. New Zealand.

8. Polynesia. In this I include the islands between Australia and Chili, except New Zealand.

9. Debatable land between North and South America, including Florida, New Mexico, Mexico, Central America, and part of Columbia, New Granada, and Cayenne. I have added this and the two following columns of debatable land for the purpose of as much as possible keeping the elements of the faunas on either side of it free from what may have been a foreign influence. The reader can carry it to the credit of either as seems to him agreeable, or omit it altogether.

10. Debatable land between the East Indies and Asia, including the Himalayas, Nepal, Silhet, the Burmese mountains, part of China, &c.

11. Debatable land between North Africa and the northern frontier of Senegal.

12. Brazilian region, the parts of South America lying east of the Andes and not above disposed of.

13. The Indian region, including the East Indies, the Malayan Peninsula, the Indian Archipelago, Siam, Cochin China, the south of China, the Philippine Islands, and New Guinea. In any list for more general purposes, New Guinea and the Philippine Islands should be kept separate; but, looking at the genera I have to deal with, this is not necessary here.

14. The West-African region, consisting of the country from Senegal to Gaboon inclusive, and eastward until it meets the East African region, wherever that may be (probably in the line of the lakes).

15. South Africa, containing Angola, Caffraria, Natal, Mozambique, and northward to Somali-land. The south of Arabia also, I believe, properly belongs to this province; but it does not happen to come into question here.

16. Madagascar. I do not include in it the neighbouring islands of Bourbon, Mauritius, Rodriguez, &c., although they do belong partly to it and partly to India; but the points in which they correspond with it are those in which Madagascar also coincides with Africa; and my object in keeping Madagascar separate is not to show its relation to Africa or India, but its more unexpected relations with South America. When I have to deal with species from the smaller islands (Bourbon, &c.), I carry them to the credit of India or Africa, according to which the affinities of the species indicate.

Note 3.—*Anchomenus.* Some of these supposed Brazilian *Anchomeni* are, doubtless, as suggested by Lacordaire, *Dyscoli*; and of others the habitat is possibly erroneous. Several of the citations are of old date, when every thing from South America was ticketed Brazil; still there are undoubted species from Brazil.

Note 4.—*Tachyporus.* (Out of more than 250) only one occurs in Nepaul, doubtless a straggler, one in Bengal (which may have been derived from an Himalayan straggler), one in Java, and one in New Guinea.

Note 5.—*Byrrhus.* I include in this the allied genera, *Curimus*, *Cytilus*, *Morychus*, and *Amphicyrtus.*

Note 6.—*Onitis.* Tolerably numerous in Europe and Asia, but only one in North America, one in India, and one in Australia.

Note 7.—*Aphodius.* Only one recorded from Brazil, out of an immense number which, with that exception, are found in the microtypal and Indo-African regions.

Note 8.—*Anoplognathus.* I have included under this head *Cotalpa* (North American) and *Brachysternus* &c. (Chilian).

Note 9.—*Pentodon.* Although not present as a genus in America, it may be present under some one or other of the American types of the Pentodontidæ, as *Podalgus*, *Heteronychus*, *Bothynus*, &c.

Note 10.—*Ancylocheira.* In this I include *Bulis* and *Asthræus.*

Note 11.—*Ampedus.* In this I include *Elater* and *Grammophorus.*

Note 12.—*Ischnodes.* By *Ischnodes* I suppose Heer to mean the second section of Candèze's *Anchastus.* The first section consists of three Brazilian species, which I omit. The second is distributed as in the Table, and, besides, contains one St. Helena species, *Anchastus atlanticus.*

Note 13.—*Cardiophorus.* Only one in Australia out of about 150 species.

Note 14.—*Telephorus.* I include *Podabrus* under *Telephorus*, not only on account of the indistinctness of the fossil specimens, but from the closeness of their natural relationship.

Note 15.—*Clerus.* I am not sure in what sense Heer intends *Clerus* to be used; and his figure scarcely helps us. I have taken it in the narrower sense in which it is now used.

Note 16.—*Gonocephalum.* In this I include *Opatrum.*

Note 17.—*Boletophagus*, including *Ulodes* and *Eledona.* I can find only one species recorded from India, without special authority. If from the Himalayas, it doubtless is a straggler from the north.

Note 18.—*Uloma.* The common species is introduced with cereals into all lands—which, as Lacordaire says, leaves its real native country in uncertainty; but, from its occurring in the Miocene fauna of Europe, it probably ought to be referred to Europe.

Note 19.—*Apion.* The debatable-land species are chiefly from Columbia, which is half microtypal.

Note 20.—*Brachycerus.* In this I include all the Brachyceridæ. It may be a question whether this form was originally African, and from Africa passed into South Europe previously to the Miocene times, or, being European, it subsequently found its way into Africa, which is now its head quarters.

Note 21.—*Hipporhinus.* Similar remarks apply to this.

Note 22.—*Acalles.* Largely represented both in itself and by allied genera in the Atlantic Islands.

Note 23.—*Cossonus.* Ditto.

Note 24.—*Lamia.* The genus *Lamia* is too large to know what type of it Heer referred his fossil to. I am in doubt and have had to leave this blank.

Note 25.—*Dorcadion.* I include the Mexican form *Monilema* as part of *Dorcadion* in this inquiry, not as otherwise a bad genus.

Note 26.—*Donacia.* Lacordaire, in speaking of the Indian and African species of *Donacia,* cites, as an interesting fact in regard to their distribution, that they have more analogy with the species of North America than with those of Europe. I cannot, however, see it.

Note 27.—*Coccinella.* The special genus or subgenus of a fossil *Coccinella* can scarcely be distinguished. I have therefore included several allied genera besides *Coccinella,* which makes it cosmopolitan. Strictly confined to the modern subgenus, it has been met with everywhere but in Polynesia and Madagascar. The vast numbers in which it has often been met with, and the appearance of flights of them migrating to other quarters, have probably something to do with its wide distribution.

2. *Orthoptera.*

Genera.	Europe and Asia.	North America.	Australia.	Chili &c.	India.	Africa.	Brazilian region.
Phaneroptera	*	*	...	...	*	...	*
Gryllacris	...	...	...	...	*	...	*
Œdipoda	*	*	*	...	*	*	
Gomphocerus (*note* 1) ...	*	*	...	...	*	...	*
Mantis	*	*	*	*	*	*	*
Blatta........................	*	*	*	*	*	*	*

Note 1.— *Gomphocerus.* This genus is divided into two sections, of which the first is confined to Europe.

3. *Neuroptera.*

Genera.	Europe and Asia.	North America.	Australia.	Chili and Polynesia.	India.	Africa.	Brazilian region.
Termes (*note* 1)............	*	*	*	* New Zeal.	*	*	*
Agrion	*	*	*	* Polynesia.	*	*	*
Æschna	*	*	*	* Polynesia.	*	*	*
Cordulia.....................	*	*	*	* New Zeal.	*	S.Afr.	*
Libellula	*	*	*	* Polynesia.	*	*	*
Phryganea (*note* 2)	*	*	...	...	...	...	?
Bittacus.....................	*	*	*	*	*	*	*
Myrmeleo	*	*	*	*	*	*	*
Leuctra	*	*					
Ictinus	...	...	...	...	*	*	

Note 1.—*Termes.* Almost entirely tropical now; but two or three small species still survive in Europe (France, &c.).

Note 2.—*Phryganea.* Used in the sense of Phryganidæ; *Phryganea* itself only occurs in the Europeo-Asiatic and North-American districts.

4. *Hymenoptera.*

Genera.	Europe and Asia.	North America.	Australia.	Chili.	India.	Africa.	Brazilian region.
Xylocopa	*	*	*	*	*	*	*
Osmia......................	*	...	...	...	...	S.Afr.	
Bombus	*	*	...	*	*	...	*
Anthophora	*	*	*	*	*	S.Afr.	*
Apis	*	...	...	...	*	*	
Vespa	*	*	...	...	*	...	
Formica....................	*	*	*	*	*	*	?
Ponera	*	...	*	...	*	*	*
Myrmica	*	*	*	*	*	*	*
Pompilus	*	*	*	...	*	...	*
Ichneumon	*	*	*	*	*	*	*
Anomalon	*	*	*	...	...	*	*
Cryptus	*	*	*	*	*	*	*
Acœnites...................	*	*					
Hemiteles	*	*	*				
Tenthredo	*	*	...	...	*	*	*

5. *Lepidoptera.*

Genera.	Europe and Asia.	North America.	Australia.	Chili.	India.	Africa.	Brazilian region.
Vanessa (*note* 1)............	*	*	*	*	*	*	
Psyche (*note* 2)	*	*	*	...	*	S.Afr.	*

There are also four new fossil genera, which Heer calls *Pierites*, *Bombycites*, *Noctuites*, and *Phalænites*, which, he says, were respectively allied to *Pieris*, *Bombyx*, and the old genera *Noctua* and *Phalæna*, which are generally distributed.

Note 1.—Also found in the Navigator Islands.

Note 2.—*Psyche.* Used in the sense of Psychidæ. The recorded species of the restricted genus *Psyche* are confined to Europe and Ceylon.

6. *Diptera.*

Genera.	Europe and Asia.	North America.	Australia.	Chili.	India.	Africa.	Brazilian region.
Chironomus	*	*	...	...	...	...	* Columb.
Tipula (*note* 1)	*	*	*	*	*	*	*
Rhipidia	*	*					
Limnobia	*	*	*	*	*	*	*
Mycetophila	*	*					
Sciophila	*	*	...	...	...	...	*
Sciara.........................	*	*	...	...	...	*	*
Rhyphus	*	*	...	* N.Z.	...	...	*
Plecia.........................	*	*	...	..	*	...	*
Bibio (*note* 2)...............	*	*	*	*B.Ay	...	*	* Columb.
Asilus.........................	*	*	*	*	*	*	*
Leptogaster	*	*	*	...	*	*	*
Syrphus......................	*	*	*	*	*	*	* Columb.
Echinomyia	*	*	...	*	*		
Anthomyia..................	*	*	*	*B.Ay	*	*	
Cordylura	*	*			*		
Tephritis	*	*	*	*		*	*
Merodon	*	*	*	...	...	*	

Note 1.—*Tipula.* Also occurs in New Zealand.

Note 2.—*Bibio.* Ditto.

7. *Hemiptera.*

Genera.	Europe and Asia.	North America.	Australia.	Chili.	India.	Africa.	Brazilian region.
Pachycoris (*note* 1)	*	*	...	...	*	*	*
Tetyra (*note* 2)	*	*	...	...	...	*	
Cydnus	*	*	...	...	*	*	*
Phlœcoris (*note* 3)	...	...	...	...	...	...	*
Pentatoma	*	*	...	...	*	*	*
Ælia	*	*	...	...	*	*	
Halys (*note* 4)	*	*	*	...	*	*	*
Eurydoma	*	*					
Eusarcoris	*	*					
Acanthosoma	*	*	...	...	*	...	*
Spartocerus (*note* 5)	...	...	...	...	...	...	*
Alydus	*	*	...	...	*	...	*
Hypselonotus (*note* 6)	...	...	...	...	*	*	*
Syromastes	*	*	...	...	*	...	*
Lygæus	*	*	*	...	*	*	*
Cephalocoris (*qu.* Cephalocterus?)	...	...	...	...	...	?	
Pachymerus	*	*	...	..	*	*	*
Heterogaster (*note* 7)	*	*	...	...	*	*	
Aradus	*	*					
Tingis	*	*	...	*	...	*	
Nabis	*	*	...	...	...	*	
Harpactor	*	*	...	...	*	*	
Pirates	*	*	...	...	*	*	*
Prostemma	*						
Evagoras	...	*	...	...	*	...	*
Nepa	*	...	...	...	*	*	
Diplonychus	*	...	...	...	*	*	
Naucoris	*	*	...	...	...	*	*
Corisa	*	*	...	...	*	*	
Micropus	*	*					

General Explanation.—In the above Table the genera are taken in the sense in which they were employed by Burmeister.

Note 1.—*Pachycoris.* Burmeister's genus *Pachycoris* included European and Old-World forms; but these are now cut off, and the genus confined to American forms; yet there is little doubt that Heer used the word in its old and wider sense.

Note 2.—*Tetyra.* Heer, in this, doubtless meant the genus *Eurygaster*, Lap.

Note 3.—*Phlœocoris,* Burm.=*Phlæa,* Le P. and Serv., is exclusively South American.

Note 4.—*Halys.* Burmeister makes *Halys* very nearly equivalent to Dallas's group Halydidæ, in which case it is represented in both hemispheres; but the principal and more typical forms are found in the Old World; two or three species occur in the south of Europe.

Note 5.—*Spartocerus.* If this genus is confined to *Spartocerus* proper, it seems to be exclusively American.

Note 6.—*Hypselonotus.* The same remark as on *Spartocerus.*

Note 7.—*Heterogaster.* This probably includes *Nysius* and *Cymus.*

8. *Homoptera.*

Genera.	Europe and Asia.	North America.	Australia.	Chili.	India.	Africa.	Brazilian region.
Cicada	*	*	**	...	*	*S.Afr.	* *
Pseudophania	*	*	...	...	*	*	*
Tettigometra	*	...	...	...	...	*	*
Cercopis	*	*	*	...	**	...	*
Aphrophora	*	*	*	*	*	*	*
Tettigonia	*	*	*	*	*	Madg.	*
Acocephalus	*	*	...	...	*	S. Afr.	*
Bythoscopus	*	*	*	...	*	*	*
Typhlocyba	*	*	...	...	...	S. Afr.	
Aphis	*	*					
Lachnus	*	?					
Pemphigus	*	*					

9. *Arachnoidea.*

Genera.	Europe and Asia.	North America.	Australia.	Chili.	India.	Africa.	Brazilian region.
Limnochares (*note* 1) ...							
Argyroneta	*						
Gea (*note* 2)	...	...	...	...	*		

Note 1.—Information defective.

Note 2.—There is an East-Indian genus named *Gea,* but if the remarks by Dr. Thorell of Upsala (an able araneologist) are to be relied on (see 'On European Spiders,' by T. Thorell, Upsala, 1870, p. 225), the fossil spider *Gea* is a different species and genus from the existing East-Indian species *Gea spinipes*; and if so, *Gea* has no existing representative genus, though the family (*Epeïrides*) is most numerous and diffused over the whole known globe.—O. P. CAMBRIDGE.

To the foregoing we may add the following, to complete the notice of Heer and Krantz's lists, which go no further, viz.:—

10. *Crustacea.*

Genera.	Europe and Asia.	North America.	Australia.	Chili.	India.	Africa.	Brazilian region.
Daphnia	*	*	*	*	*	*	?

11. *Polypi.*

Hydra	*	*					
Lucernaria	*	...	*				

TABLE II.—Showing the geographical distribution of the genera found in the middle and eastern (or next to America) portion of Polynesia.

Those which I suppose to have been introduced from microtypal sources subsequently to the establishment of the Brazilian and African types are marked with a †.

M. stands for Miocene, the genus being in Heer's lists.

Genera.		Doubtful.	Cosmopolitan.	Microtypal stirps.					Brazilian stirps.	Indo-African stirps.	
				Europe and Asia.	North America.	Chili.	New Holland.	New Zealand.	Brazilian region.	India.	Africa.
Plochionus		*									
Lebia		...	...	*	*	*	*	...	*	*	*
Chlænius	M.	...	...	*	*	...	*	...	...	*	*
Harpalus	M.	...	...	*	*	*	*	...	†	†	
Anchomenus	M.	...	...	*	*	*					
Bembidium	M.	...	...	*	*	*	...	...	...	...	†
Colymbetes	M.	...	...	*	*	*	*	*	...	...	†
Agabus	M.	...	...	*	*	*	...	...	...	...	†
Gyrinus		...	...	*	*	*	*	...	*	*	*
Bolitochara		...	...	*							

TABLE II. (*continued*).

Genera.	Doubtful.	Cosmopolitan.	Microtypal stirps.					Brazilian stirps.	Indo-African stirps.	
			Europe and Asia.	North America.	Chili.	New Holland.	New Zealand.	Brazilian region.	India.	Africa.
Placusa	...	...	*	*						
Staphylinus M.	...	...	*	*	*	*	*	†	†	†
Philonthus M.	...	...	*	*	*	*	...	†	†	†
Sunius M.	...	...	*	*						
Zirophorus	...	...	...	...	...	...	...	*	*	
Lispinus	...	...	...	*	...	...	...	†		
Isomalus	...	...	...	...	...	...	...	*		
Chrysodema	...	...	...	...	...	...	...	...	*	*
Eurythyrea M.	...	...	*							
Agrilus M.	...	...	*	*	*	*	...	...	†	†
Photophorus (peculiar to Polynesia, but allied to *Pyrophorus*, which is Brazilian)	...	...	...	...	...	...	...	*		
Dicrepidius (doubtful if really this genus, see Candèze)	...	...	...	*	...	...	...	*		
Monocrepidius	...	...	...	*	*	*	...	*	†	
Simodactylus, allied to *Eudactylus*	...	...	...	...	...	*	...	*		
Oophorus (the old genus of this name had no good characters; and as Candèze has broken it up and partitioned its contents, it is impossible to say where Fairmaire's insects should go; Candèze himself does not say, but suggests *Heteroderes*)	*									
Adelocera	...	...	*	*	*	...	...	†		
Cylidrus	...	...	...	...	...	*	...	...	*	*
Tarsostenus	...	...	*	*	...	...	...	...	*	*
Tillus (*Clerus* is the Miocene genus, but it may be held to include *Tillus*) M.	...	...	*	*	*	*	...	...	*	*
Corynetes	...	...	*	*	*	*	*	*	*	*
Carpophilus	...	...	*	*	*	*	...	*	*	*
Nitidula } M.	...	...	*	*	*					
Epurea	...	...	*	*						
Stelidota	...	...	...	*	?	..	...	?	?	
Anthrenus	...	...	*	*	...	*	...	...	...	*
Dermestes M.	...	...	*	*	*	*	*	?	?	*
Platysoma	...	...	*	*	...	*	...	...	*	*
Paromalus	...	...	*	*	...	...	...	...	...	*

TABLE II. (*continued*).

Genera.	Doubtful.	Cosmopolitan.	Microtypal stirps.					Brazilian stirps.	Indo-African stirps.	
			Europe and Asia.	North America.	Chili.	New Holland.	New Zealand.	Brazilian region.	India.	Africa.
Hydrobius M.	...	...	*	*	...	*	...	...	...	†
Philhydrus M.	...	...	*	*	*	...	...	...	*	*
Cyclonotum	...	...	*	*	*	...	...	*	*	*
Aphodius M. Oxyomus	...	...	*	*	*	*	...	*	*	*
Oryctes	...	...	*	...	...	*	...	...	*	*
Figulus	...	...	...	...	...	*	...	...	*	*
Dorcus (Alcimus)	...	...	*	*	*	*	*	*	*	
Passalus	...	...	...	*	*	*	...	*	*	*
Opatrinus ? (real genus doubtful)	*									
Leichenum	...	...	*							
Boletophagus	...	...	*	*	...	...	*	...	†	
Diphyrynchus (probably allied to *Uloma, fide* Lacordaire)	*									
Heterophaga (the species cited is cosmopolitan)	...	*								
Uloma M.	...	...	*	*	...	...	*	*	*	*
Tribolium	...	*								
Cerandria	...	*								
Amarygmus	...	...	...	...	...	*	...	...	*	
Olisthæna	...	...	...	...	...	*				
Anthicus	...	...	*	*	...	...	...	...	?	
Mordella	...	...	*	*	*	*	?	*	†	
Zonitis	...	...	*	*	...	*	...	...	†	†
Nacerdes	...	...	*	...		*	*	†	†	
Selenopalpus	...	...	...	...	...	...	*			
Dinema	...	...	...	...	...	...	...	...	*	
Rhinobrachys (supposed by Lacordaire to be near *Protædus*, Pasc., a New-Guinea form)	*									
Tropideres	...	...	*	*	*	*	...	†	†	*
Sphærorhinus Trigonops ... Celeuthetes ... Psomeles ...... Elytrurus ... } The Otiorynchidæ of Polynesia & the Indian archipelag. The rest of the family are Europæo-Asiatic & Brazilian.										
Acicnemis	...	...	...	...	...	...	...	...	*	
Cryptorhynchus M.	...	...	*	*	*	*	...	*	†	†
Tylodes (doubtful, *fide* Lacordaire; probably should be *Acalles*) M	*									

TABLE II. (*continued*).

Genera.	Doubtful.	Cosmopolitan.	Microtypal stirps.					Brazilian stirps.	Indo-African stirps.	
			Europe and Asia.	North America.	Chili.	New Holland.	New Zealand.	Brazilian region.	India.	Africa.
Acalles ....M.	...	...	*	...	*	*	...	†	†	
Sitophilus	...	*								
Calandra	...	...	*	*	*	...	...	†	...	Madag.
Dryophthorus	...	...	*	*						
Cossonus ....M.	...	...	*	*	*	...	...	...	?	†
Amorphocerus	...	...	...	...	...	...	...	...	...	*
Brenthus	...	...	...	...	*	...	...	*		
Catolethrus	...	...	...	...	...	...	...	*		Madag.
Proëces	...	...	...	...	...	...	...	...	...	
Rhyncolus........	..	...	*	*	*	...	...	*	*	*
Psepholax (resemble Scolytidæ).										
Apate	*									
Platypus	...	...	*	*	*	...	...	*	*	*
Temnorhopalon (position and affinities not known, supposed near *Cerylon*).										
Cicones	...	...	*	*						
Ditoma	...	...	*	*	...	...	...	?		Madag.
Cerylon	...	...	*	*	...	...	...	...	...	
Emmagleus	*									
Silvanus..................................	...	...	*	*	...	*	...	...	†	
Rhizophagus	...	...	*	*						
Trogosita	...	...	*	*	...	...	*			
Læmophlœus...........................	...	...	*	*	...	...	...	?	?	
Dendrophagus	...	...	*	*	...	*	*			
Mallodon (belongs to the Remphanidæ)................................	...	...	†	...	*	...	...	Ph. *	*	
Obrium	*									
Stromatium	*									
Steirastoma	...	...	...	...	...	...	...	*		
Ptychodes	...	...	...	*						
Lagocheirus	...	...	...	...	...	...	...	*		
Clytus.....................................M	...	...	*	*	*	*	...	*	*	*
Hesperophanes	...	...	*	*	*					
Oopsis.										
Saperda ....M	...	...	*	*	...	*	...	...	*	*
Promecotheca	...	...	...	...	...	...	...	...	*	
Raphidopalpa	...	...		...	...	†	...	...	*	*
Aulacophora	...	...	...	...	...	†	...	...	*	*
Cryptocephalus	...	...	*	*	*	*	...	*	*	*
Coccinella ....M	...	...	*	*	*	*	*	*	*	*

Table III.—Showing relations of genera found in New Caledonia. (From Montrouzier's Essay in Ann. S. Ent. 1860.)

Genera.	Microtypal.		Indo-African.	Brazil.	Universal.
	Europe, Asia, and N. America.	Australia.			
Cicindela	*	*	*	*	*
Distipsidera	...	*			
Cymindis	*				
Tricothorax, n. gen.					
Scarites	*	*	*	*	*
Chlænius	*	*	*	*	*
Lissauchenius	...	...	*		
Ophonus	*				
Rembus	...	...	*		
Catascopus	...	...	*		
Feronia	*				
Abax	*				
Catadromus	...	*			
Bembidium	*				
Cybister	*	*	*	*	*
Colymbetes	*				
Copelatus	...	...	*	*	
Pachytes, n. gen.					
Dineutes	*	*	*	*	*
Ochthebius					
Stagnicola, n. g.					
Hydrobius	*				
Hydrophilus	*	*	*	*	*
Buprestis (Cyria ?)	...	*			
Abrobapta (Melobasis)	...	*			
Diphucrania	...	*			
Agrypnus	*	*	*	*	*
Athous ?	*				
Ludius	*				
Elater	*	*			
Nycterilampus.					
Laius.					
Lomechusa ?	*				
Cylidrus	*	*	*	*	*
Clerus	*	*	*	*	*
Notoxus	...	*			
Necrobia	*	*	*	*	*
Ptinus	*	*	*	*	*
Ips	*				
Mycetophagus	*				
Dermestes	*	*	*	*	*
Trinodes	*				
Macrosternus					
Saprinus	*				

Table III. (*continued*).

Genera.	Microtypal.		Indo-African.	Brazil.	Universal.
	Europe, Asia, and N. America.	Australia.			
Onthobium (near *Tessarodon*)	...	*			
Aphodius	*	*	*	*	*
Sphæridium	...	...	*		
Rhizotrogus	*	*	*	*	*
Cyclocephala	...	...	...	*	
Hexodon	...	*			
Scarabæus	*	*	*	*	*
Ceratophyus	*				
Oryctes	...	...	*	*	
Megalæmus, n. gen.					
Lucanus	*	*	*	*	*
Ryssonotus	...	*			
Figulus	...	*			
Passalus	...	...	*		
Opatrum	*				
Toxicum					
Acanthosternus		...	*		
Neomida	*				
Diaperis	*				
Leptomorpha	*				
Pachycorus, n. gen.					
Tenebrio	*	*	*	*	*
Uloma	*	*	*	*	*
Tribolium	*				
Trogosita?	*	*	*	*	*
Megapalpus, n. gen.					
Isopus, n. gen.					
Phaleria	*				
Adelium	...	*			
Ditylus	*				
Lagria	*	*	*	*	*
Mordella	*				
Telephorus	*				
Nacerdes	*				

List of non-microtypal Species in the Coleoptera of Polynesia, and their sources (all the rest are microtypal).

I. North America.—*Clytus erythrocephalus* and *Ptychodes vittatus*, Longicorns (timber-borers).

II. Brazil.—*Lagocheirus araneiformis* and *Steirastoma stellio*, Longicorns (timber-borers); *Brenthus bidentatus*, a Brenthid (timber-species).

III. East Indies and Philippine Islands.—*Chlænius guttatus*, a Carabid (carnivorous hunting insect); *Hesperophanes luzonicus*, Longicorn (timber-borer); *Figulus fissicollis* (Lucanid), *Apate religiosa* (Xylophage), and *Eurythyrea scutellaris* (Buprestid)—timber-insects.

IV. New Holland.—*Oopsis nutator*, Longicorn (timber-borer); *Amarygmus hydrophiloides*, Heteromere, and *Apate pusilla*, Xylophage (timber-insect); *Nacerdes bivittata*, Heteromere, and *Staphylinus erythrocephalus*, Staphylinid (microtypal).

V. New Zealand.—*Dendrophagus suturalis*, Cucujid (bark-insect); *Staphylinus oculatus*, Staphylinid (microtypal).

VI. Cosmopolitan, origin doubtful.—*Plochionus bonfilsii*, Carabid.

List of Genera and Species found in the Europæo-Asiatic regions, and also in North-west America, but not in the eastern side of North America.

I. Genera.—*Callisthenes*, *Miscodera*, *Leistus*, *Trachypachys*, *Pelophila*, *Anillus*, *Necrophilus*, *Pteroloma*, *Lyrosoma*, *Sphærites*, *Bolitochara*, *Syntomium*, *Phlœonæus*, *Arpedium*, *Deliphrum*, *Malachius*, *Calcar*, *Rosalia*, *Ergates*, *Mesosa*, *Timarcha*.

II. Species belonging to other genera than the above.—*Platynus Bogemanni*, *Carabus Vietinghovii*, *Colymbetes dolabratus*, *Necrophorus mortuorum*, *Olisthærus megacephalus*, *Elater nigrinus*, *Corymbites confluens*, *Helodes variabilis*, *Dinoderus substriatus*, *Serropalpus striatus*, *Chrysomela lapponica*, *C. viminalis*.

List of Genera of Coleoptera of Old Calabar either Brazilian or with Brazilian affinities, taken from my "Coleoptera of Old Calabar" (so far as published) in the 'Annals and Mag. of Nat. Hist.'

Galerita, *Lia*, *Goniotropis*, *Hypolithus*, *Celina*, *Contipus*, *Axyra*, *Taracta*, *Platychora*, *Melittoma*, *Ptilodactyla*, *Dilobotarsus*, *Belionota*, *Parandra*, *Dorycera*, *Callichroma*.

Brazilian section.—*Œme*, *Œdenoderus*, *Trachelophanes*, *Distenia*, *Smodicum*, *Stenochia*.

Note.—The other Tables referred to in the body of this paper, and which accompanied it, relate to matters which are more generally admitted; and it has therefore not been thought necessary to print them.